TERRAEducation 2010

CRAterre – National Superior School of Architecture of Grenoble

Grands Ateliers de l'Isle d'Abeau / Great Workshops of l'Isle d'Abeau

Extra-muros programme, Cité de la Construction Durable
and 8th Festival « Grains d'Isère 2010 »

Proceedings of the seminar - workshop

Summary of works

Under the direction of Hubert Guillaud
In coordination with the members of the seminar's scientific committee,
in collaboration with the thematic workshop's moderators and rapporteurs
and the workshop's participants

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National Superior School of Architecture of Grenoble

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Summary of work

Under the direction of Hubert Guillaud
In coordination with the following members of the seminar's scientific committee :
Maddalena Achenza, Erica Avrami, Mariana Correia, Luis Fernando Guerrero Baca, Hugo Houben

In collaboration with the thematic workshop's moderators and rapporteurs :
Kathleen Dardes, Emmanuelle Devaux, Alexandre Douline, Laetitia Fontaine, David Gandreau, Bakonirina Rakotomamonjy

And the workshop's participants :

Workshop 1 :
Revision of the types of higher education and vocational training curricula available, educational tools and learning methods : developments and necessary adaptations in view of society's needs and expectations
Isa Abdul, Umar Abdullahi, Claudia Cancino, Kathleen Dardes, David Gandreau, Philippe Garnier, Hugo Houben, Thierry Murat, Islam Shariful, Horst Schroeder, Francisco Javier Soria López.

Workshop 2 :
Strategic directions for research and doctorate programmes : what research priorities to develop in order to meet the expectations and needs of society ?
Gerhard Bosman, Mariana Correia, Marcelo Cortes Alvarez, Minchol Cho, Laetitia Fontaine, Mauricio Ganduglia, Luis Fernando Guerrero Baca, Eduardo Salmar Nogueira e Taveira, Jenny Vargas.

Workshop 3 :
Methods of evaluation and validation of skills learned ; certification of professional qualifications
Robert Bidime'Nouga, Lydie Didier, Alexandre Douline, Rosario Etchebarne, Uta Herz, Serge Maïni (Satprem), Adolphe Mayogi, Jean-Marc Mei, Michel Mourier, Elena Ochoa Mendoza.

Workshop 4 :
Difficulties, gaps and blockages / opportunities and contributions for education and specialized training development in earthen construction and architecture
Maddalena Achenza, Erica Avrami, Maria Fernandes, José Raul Moreno Cardenas, Ishanlosen Odiaua, Bakonirina Rakotomamonjy, Mirta Sosa, Abdelghani Tayyibi, Marcelo Washl, José Manuel Rivas Zacatares.

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Welcome

Dear colleagues, dear friends,

On behalf of all of us here in CRAterre, I welcome you to this week's TERRAEducation 2010 seminar workshop, under the auspices of the UNESCO Chair and the Great Workshops, the ENSAG, and with the support of the Rhône-Alpes region and the German NGO MISEREOR. Many of you responded to our invitation and we are really pleased to have you here.

In October 2001, the first International UNESCO Chair and Terra Consortium meeting took place on the subject of “Teaching earthen architecture in the world: achievements and prospects”. The results of this first international meeting, beyond the presentations made, were remarkable; they confirmed the existence of an international group of dynamic higher education and training professionals in the field of earthen construction and architecture and revealed the knowledge gained thanks to the great effort and energy from personalities and institutions, clearly determined and mobilized even while working with insufficient financial means.
These results allowed us to better appreciate the situation and to express important recommendations for the integration of permanent and institutionalized of earthen architecture education curricula, and also to better connect higher education, training, research activities, projects and the dissemination of information and knowledge.

Our aim was also to allow those trained to better fulfill their social role as future trainers, professional actors and “facilitators” of local sustainable development. We were clearly aware of the need to promote earthen architecture and include it as part of wider concerns dealing with the core issues of society: the struggle for the eradication of poverty, access to decent housing, improved living conditions, the boosting of local economies enhancing the resources of local territories as well as local knowledge and know-how and the preservation of our natural and cultural environments and of our heritage.

Where are we at, almost 10 years later? How far have we come, separately or together? How did we truly seize and handle, in the realm of our field, the social issues that were exposed then and that have become even more urgent today? What new occurrences seem to call for the amplification of an international movement for the development of earthen architecture? How to re-examine the need for a broader education, the place and impact of research both fundamental and applied, how to design and project, facing larger challenges concerning the development of pedagogical, scientific, professional and cultural tools? What about post-training challenges? What skills and capacity-building actions are needed to take a new leap towards the future while major technological revolutions in the fields of Information and communication have emerged so quickly, while population and urban density issues and questions about the dimensions of eco-housing projects force us to find innovative answers integrating traditional cultures and modern technologies, while issues of transdisciplinarity and inter-culturalism are at the heart of the debate… How can we bring about the changes and developments needed to build a future which, in many respects, seems already threatened? These questions require us to fundamentally rethink the content of curriculums, the transdisciplinarity of teaching and teaching methods, the methods for the validation of achievements as well as the references and trading standards. So, we have many questions that challenge our attitudes as teachers, trainers, researchers, and professionals.

We will once again share our experiences, think and work together. Such an opportunity is always unique and rare. We will certainly benefit from this opportunity to better define a shared common vision of the future of earthen architecture serving companies and organizations in the world that also contribute to the maintenance of social cohesion, so necessary for the practical implementation sustainable development. A paradigm for which two new pillars are needed: culture and governance, which are a welcome addition to the social, economic and environmental pillars already considered.

We wish us all a successful collaboration, good work and good times together.

Hubert GUILLAUD and Hugo HOUBEN

CRAterre-ENSAG

UNESCO Chair Earthen Architecture, Building Cultures and Sustainable Development

National School of Architecture, Grenoble

May 24th, 2010

TERRAEducation 2010

SUMMARY OF WORKS

1 - INTRODUCTION

A broad international participation

TerraEducation 2010 was held at the National Superior School of Architecture of Grenoble (ENSAG) from May 24 to 29, 2010, and was organized by CRAterre-ENSAG and the UNESCO Chair "Earthen Architecture, Construction Cultures and Sustainable Development", in collaboration with the Great Workshops of l'Isle d'Abeau. This seminar brought together 41 participants from 4 continents - Africa, America, Asia and Europe - and 22 countries:

- **Africa** : South Africa, Angola, Cameroon, Democratic Republic of Congo, Morocco, Nigeria, Uganda.
- **America** : Argentina, Brazil, Chile, Colombia, United States of America, Mexico, El Salvador, Uruguay.
- **Asia** : Bangladesh, India, Republic of Korea.
- **Europe** : Germany, France, Italy, Portugal.

Seminar participants represented a wide range of institutions and organizations:

- International organizations;
- Public universities, architecture, urban planning, engineering and civil engineering departments;
- Private higher education institutions;
- Architecture / engineering / archaeology centers and research laboratories;
- Vocational training centers;
- Nongovernmental organizations;
- Private foundations;
- Professional associations and regional, national and international networks.

Acknowledgements

We wish to thank all institutions, all organizations and their representatives who contributed to the smooth running of TERRAEducation 2010 and who made rich contributions to our different workshops. We particularly wish to thank:

- Member institutions of the UNESCO Chair Earthen Architecture and their representatives from several countries within the network;
- Members of the Ibero-American PROTERRA network and the institutions they represented;
- European network members in Germany (Dachverband lehm e.V) and in France (ASTerre) ;
- Representatives of the International Scientific Committee of Earthen Architectural
- Heritage, ICOMOS (ISCEAH);
- The World Monument Fund;
- The Getty Conservation Institute;

We wish to thank the following individuals:

Maddalena ACHENZA, I.I. ADOKE, Romain ANGER, Yolanda ARANDA JIMÉNEZ, Erica AVRAMI, Gerhard BOSMAN, Claudia CANCINO, Wilfredo CARAZAS-AEDO, Gilberto CARLOS, Minchol CHO, Laure CORNET, Mariana CORREIA, Rui CORREIA, Marcelo CORTES ALVAREZ, Kathleen DARDES, Emmanuelle DEVAUX, Lydie DIDIER, Patrice DOAT, Alexandre DOULINE, María Del Rosario ETCHEBARNE SCANDROGLIO, Maria FERNANDES ALEIXO, Laetitia FONTAINE, David GANDREAU, Mauricio GANDUGLIA, Philippe GARNIER, Luis Fernando GUERRERO BACA, Hubert GUILLAUD, Uta HERZ, Hugo HOUBEN, Heyzoo HWANG, Abdul ISA, Mohammad Shariful ISLAM, Thierry JOFFROY, SATPREM (Serge Maïni), Stephan JÖRCHEL, Soonwung KIM, Stella Maris LATINA, Adolphe MAYOGI, Jean-Marc MEI, Rafael Francisco MELLACE, Jacob MERTEN, Olivier MOLES, Jesús Antonio MORENO, José Raül MORENO, Santiago MORENO, Michel MOURIER, Thierry MURAT, Eduardo Salmar NOGUEIRA E TAVEIRA, Robert NOUGA BIDIME, Elena OCHOA, Ishanlosen ODIAUA, Grégoire PACCOUD, Bakonirina RAKOTOMAMONJY, José Manuel RIVAS ZACATARES, Rubén Salvador ROUX GUTIÉRREZ, Ulrich RÖLHEN, Y.O. SADIQ, Clara Eugenia SANCHEZ, Horst SCHRÖEDER, Francisco Javier SORIA LÓPEZ, Mirta Eufemia SOSA, Abdelghani TAYYIBI, Abdullahi UMAR, Marcelo WASCHL.

The organization and good running of the seminar-workshop would not have been possible without the support and the invaluable assistance provided by:
- Nathalie Chapuis and Marie Toussaint (secretariat CRAterre ENSAG);
- Marina Trappeniers (responsible management at CRAterre-ENSAG); and,
- Leticia Delboy (translator and logistics of the seminar - workshop).

Last, we wish to thank the institutions and organizations that have provided the financial or material support that allowed facilitating broad international participation to the seminar-workshop:
- The Division de l'Enseignement Supérieur et de la Recherche (Division of Higher Education and Research) of the Rhône-Alpes region, in the framework of the Schéma Régional de l'Enseignement Supérieur et de la Recherche (SRESR) 2007-2010;
- The German NGO MISEREOR;
- The National Superior School of Architecture of Grenoble (ENSAG);
- The Grands Ateliers (Great Workshops) of l'Isle d'Abeau;
- The association of municipalities of North Isère « Isère Porte des Alpes » ;
- The Conseil Général (General Council) of Isère (CG 38).

Context and objectives of the seminar (brief description)

The international scientific and academic community invested in earthen architecture education (higher education and vocational training) was invited to share and analyze experiences in the field.

The seminar aimed to better assess the strengths and weaknesses of activities in the field that have been developed in recent years and to point out the blockages, bottlenecks and deficiencies that should be overcome in the future. It also aimed at evaluating new opportunities for the improvement and spreading of educational activities, with a better international coordination, while facilitating collective thinking and prospecting.

The following objectives were envisaged through the seminar-workshop:

- Analyze experiences in education for earthen architecture at all levels: higher education and vocational training, education and public awareness;
- Help structuring earth architecture as a discipline, through education: better identify the body of theoretical knowledge, methods and educational practices;
- Reflect together on the development of teaching methods for a better acquisition of knowledge and expertise;
- Reflect on the skills base of building and earthen architecture trades, and on how to assess these skills;
- Assess the impact of research on education, including the development of doctoral research in the field; identify priority research areas;
- Contribute to the establishment of an international platform for earthen architecture education excellence;
- Define a common vision for the future development of education: laying the foundations for a reference document defining a common, synergistic action plan;
- Write a TerraEducation Seminar 2010 summary, which will be distributed among participants and made available on network partner sites.

Three main questions were addressed through the seminar's specific work objectives:

- Where do we come from? History and development of education for earthen architecture in the past thirty years.
- Where are we at? Analysis of the current situation.
- Where are we headed? Future Vision, Strategy and Action Plan for the next 5/10 years.

Activities and work methods

TERRAEducation 2010 made it possible for a wide range of activities to take place:

The first two days were dedicated to the presentations of participants, organized into six themes:

1 - Education curricula/higher education programs;
2 - Education curricula/vocational training programs;
3 - Teaching and research;
4 - Didactics;
5 - Sensitization in educational contexts and for the general public;
6 - Skill base and validation systems.

A format for the publishing of articles was previously established and announced to all seminar participants. A compilation of TERRAEducation 2010 papers[1] were published before the seminar: twenty-two articles written by participants plus introductory articles as well as the presentation of general work objectives and the thematic workshops.

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[1] AA.VV. 2010 – *TerraEducation 2010. Communications – Lectures – Ponencias*. Editions CRAterre ENSAG, Grenoble, mai 2010, 237 p.

In the evening of the second day, an experimental lecture on building with mud was given to seminar participants by two young researchers from the CRAterre-ENSAG laboratory, Laetitia Fontaine and Romain Anger. This conference was held at the castle of Vellein, in Villefontaine, and also hosted a very large group of local and regional attendants.

On the third day, the Grands Ateliers (Great Workshops) of l'Isle d'Abeau were visited, which at the time hosted a variety of activities implemented by post-master DSA-Earth students and “Cultures constructives” (Building cultures) Master students from ENSAG, in the framework of the eighth annual festival “Grains d'Isère”, organized in collaboration with “Isère, Porte des Alpes”, an association of North Isère municipalities.
That same day provided an opportunity to visit the eco-housing prototype “Armadillo Box”®, developed as part of the participation of “Building cultures” master students from ENSAG in the “Solar Decathlon Europe” international competition (Madrid, June 2010).

The fourth and fifth days were dedicated to group work around the four workshop themes:

- **Workshop 1:** Revision of the types of higher education and vocational training curricula available, educational tools and learning methods: developments and necessary adaptations in view of society’s needs and expectations.
- **Workshop 2:** Strategic directions for research and doctorate programmes: what research priorities to develop in order to meet the expectations and needs of society ?
- **Workshop 3:** Methods of evaluation and validation of skills learned; certification of professional qualifications.
- **Workshop 4:** Difficulties, gaps and blockages / opportunities and contributions for education and specialized training development in earthen construction and architecture.

At the end of the fifth day, results from the four thematic workshops were shared during a plenary session.

Finally, on the sixth day, a select group of participants reuniting the members of the scientific Committee spent half of the day structuring the results and conclusions from the TERRAEducation 2010 thematic workshops that had just taken place.

2 – OUTCOME

The recognition of earthen architecture as a discipline

The TERRAEducation 2010 seminar, as part of an expanding series of academic and scientific international events that are taking place more and more frequently, confirms the emergence of earthen architecture as a "proper" discipline, complete in itself and currently evolving, as stated by Hugo Houben[2] during the seminar TERRA 2008 that took place in Bamako, Mali.

A long road has been traveled since the first international conferences held in Iran (Yazd 1972 and 1976) took place, as we anticipate the organization of the 11th International Conference on the Study and Conservation of Earthen Architectural Heritage in Peru, in 2012 and other regional conferences are being planned (in Latin America, Mexico, SIACOT XI, at the University of Tampico, Tamaulipas, México in September 2011, in Asia, Republic of Korea, in October 2011 and the second Mediterra conference in 2013).

Indeed, earthen architecture is emerging as a discipline, at the heart of a meta-discipline, architecture, which encompasses it. Earthen architecture, a transdisciplinary domain, is settled at the crossroads of social sciences, materials science, civil engineering, building construction and the arts. It is a new discipline, emerging as such over the past forty years, and it is now a field of knowledge, scientific and technical knowledge, occupying a space of its own, as a field of specialization of skills for the exercise of a wide range of activities, in areas dealing with the conservation and valorization of heritage buildings.

Earthen architecture is becoming a subject taught in higher education institutions, in universities, their faculties of architecture, engineering or civil engineering, as well as in professional training centers preparing students for careers in building. A discipline that has its own curriculum developed from a theoretical and practical perspective at various levels of education, complete with its associated educational programs and activities. A discipline that could contribute to innovation in teaching by strengthening the link between the theoretical bases in the development of a project and the heuristics of "doing" (experimental construction activities at the core of architectural thinking). A taught discipline that validates achievements in terms of knowledge and skills with special training certificates and diplomas[3]. A taught discipline that questions the need for a renewal of didactic thinking to better face today's new social challenges and train future professionals capable of responding to these challenges. A true change of scale has taken place.

Earthen architecture is a research field that started to characterize its scientific scope in the 1980s, through the work of research units that contributed to determine emerging ways to study earth and define research priorities[4]. This work was recently updated in the field of earthen architecture conservation, through a literature review[5] covering this field of research and application. The scientific scope of this specific discipline questions the physical chemistry of matter and materials, building cultures and techniques, the archeology and history of earthen architecture, both official and popular, the anthropology of habitat, the conservation and management of built heritage, social economics as well as the technological, architectural and innovations in construction for the promotion of eco-housing. It is within this scope that many programs and research projects have been developed, and evaluated by accredited national bodies, which have significantly contributed to strengthening knowledge and education. The multiplication of specialized research units and centers worldwide - most often attached to universities, colleges and graduate schools - confirms the existence of an active community of teachers and researchers. The increasing number of responses to "targeted" research tenders by a growing number of countries and internationally shows that the scientific community is actively involved in the production, publication and dissemination of knowledge. All this adds to the construction of the theoretical, scientific and academic recognition of this emerging discipline. A new level has been reached.

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[2] **Hugo Houben 2008 :** HOUBEN, Hugo – L'architecture de terre, une discipline à part entière ? Keynote Address, in *Terra 2008 : The 10th International Conference on the Study and Conservation of Earthen Architectural Heritage*, Proceedings, ed. The Getty Conservation Instute, Los Angeles, U.S.A., 413 p., pp. 1-4.

[3] See the European system ECVET that was presented during TERRAEducation 2010, resulting from a previous European programmes dealing with the vocational training on earthen plastering, in the frame of the Programme Leonardo: **Didier et al. 2010 :** DIDIER, Lydie, DOULINE, Alexandre, HERZ, Uta - Cap sur la terre : le Système ECVET Construire en terre pour se former en Europe. In *TERRAEducation 2010, communications – Lectures- Ponencias*. Editions CRAterre-ENSAG, Grenoble, France, 2010, 237 p., pp. 210-217.

Earthen architecture is also a huge field of application resulting in the realization of projects, worldwide: conservation projects that contribute to the valorization of local heritage and the preservation of cultural diversity, housing and public building construction projects which draw more and more architects and contractors to respond to growing demands from public and private clients. Earthen architectural projects are becoming more present within the built landscape, both as part of a cultural *continuum* and as “contextual” contemporary productions.

Several renowned architects are enthusiastically contributing to this revival, thus inspiring a new generation of students, future professionals who will ensure the legacy of the movement. The actual application of eco-housing renews interest in natural materials and demands that their classical use be reinterpreted, rethinking the earthen architecture project. This requires an innovative hybridization of both traditional and modern materials and techniques, and the development of new technologies from environmental engineering (solar, wind). This is a very promising field of research & development (R & D) and experimental application. The significant developments in earthen architecture, reinforced by the publication of professional coding rules, practices and standards, as well as by technical design literature, brings the theoretical corpus of Earthen Architecture up to the level of a true discipline.

The international community invested in the earthen architecture revival addresses some of the major issues facing society today: the reduction of poverty and underdevelopment, poor housing conditions and the access to housing for the greatest number, eco-architecture and the conservation of scarce resources such as non-renewable energy, control of environmental pollution and climate change, population growth and urban growth due to migration from rural to urban environments, protection of cultural diversity in the midst of globalization, and finally the preservation and evolution of societal values carried by architectural heritage and their contribution to local sustainable development.

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[4] **CRAterre, Houben et al. 1983 :** HOUBEN, Hugo, GUILLAUD, Hubert, DAYRE, Michel, DOAT, Patrice – *Recherche Terre ; Recherche Exploratoire sur le Matériau Terre. Vol. 1 : Les Voies de la Recherche, 198 p. ; Vol.2 : L’Etat de l’Art de Construire*. Plan Construction. Editions AGRA-UPAG/CRAterre, Grenoble, France.

[5] **Avrami et al. 2008 :** AVRAMI, Erica, GUILLAUD, Hubert, HARDY, Mary, editors - Terra Literature Review: An Overview of Earthen Architecture Conservation, The Getty Conservation Institute, Los Angeles, U.S.A., 2008, 174 p. (can be downloaded from GCI’s Web site).

These are the factors that define the true academic and scientific scope encompassed, and that validate the reality of the establishment of the discipline.

An update on education practices and a rich experience feedback

Nine years after the first international meeting of the UNESCO Chair "Architecture, building cultures and sustainable development" and the Consortium TERRA (3 to 5 October 2011[6]), which brought together 42 international participants, TERRAEducation 2010 presented a rare and exceptional second opportunity for the modernization and development of education practices worldwide, rich shared experiences and positive feedback. The papers presented by participants and the items published in the proceedings are of high quality and concretely illustrate the large scale changes mentioned earlier. They also reflect the beginnings of convergent questions that are enabling to generate a shared vision of the future of education in earthen architecture. A future, now more firmly based on numerous experiences, tangible results and evaluations, and the certainty that this material, earth, used for millennia by mankind to build homes, may still be useful to society, but also contribute to resolve other environmental challenges that must be tackled with intelligence as well as efficiency, as an exemplary material to implement a sustainable development paradigm in a variety of ways, an antidote to the inevitable loss of culture experienced throughout the world.

Let's look more specifically, in light of participants'contributions, the main achievements at TERRAEducation:

- Earthen architectures, which stem from local-scale, vernacular “building cultures” that have a low environmental impact, and which allow a certain “social sustainability”, offer sufficient technological alternatives for them to be considered as belonging to the next level in the evolution of qualitative development of built environments, particularly in developing countries. Earthen architectures might enable them to skip steps in avoiding the mistakes that were made by developed countries (concept of "leapfrogging" evoked by Erica Avrami[7]). But for this, we must improve technology, innovate in terms of social, economic and environmental “sustainability", involving traditions (cultures, knowledge and local know-how) and modernity (science and engineering), and ensure broad public accessibility to this sustainable technology. The dynamics of self-construction should be better understood (80% of the world population lives in a self built housing using local materials), taking into account habitat at all scales (in building materials, at the scale of a district, a city or a given territory), and the conditions for a good governance and sustained investment should be established. Education should also contribute to the development of research, again at all scales (from the earth particle to the territory), to develop and enhance collaborations, to help create a shared vision between academia, the public and private sector. Programmes based on community participation should also be implemented, advancing the development of professional skills involved in construction and the acquisition of a certain analytical skill-base to generate "facilitators" of development, in conjunction with the local communities, which should also help maintain continuity and cohesion. However, as Erica Avrami rightly said, earthen architecture in itself can only provide better development if it is integrated in a sustainability agenda, that is to say in programmes of a social, economic and environmental nature.

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[6] **AA.VV. 2001 :** Architecture de terre, cultures constructives et développement durable, Chaire UNESCO – in Consortium TERRA, *Réunion internationale Enseigner l’architecture de terre dans le monde : bilan et prospectives*, CRAterre-Ecole d’Architecture de Grenoble, 3 – 5 octobre 2001, Rapport de Synthèse, éditions CRAterre-EAG, Grenoble, France, décembre 2001, 22 p.

AA.VV. 2001 : Earthen architecture, building cultures ans sustainable dévelopment, UNESCO Chair – in TERRA Consortium, International workshop *Earthen architecture education in the world : current status and future directions*, CRAterre-Ecole d’Architecture de Grenoble, 3 – 5 octobre 2001, Workshop Report, éditions CRAterre-EAG, Grenoble, France, décembre 2001, 22 p.

[7] **Avrami 2010 :** AVRAMI, Erica – *The Leapfrog potential of earthen architecture*. In recueil des communications de TERRAEducation 2010. Ed. CRAterre-ENSAG, Grenoble, France, 237 p., pp. 50-55.

- Developing countries are facing an exponential increase of the urban population due to an increasingly pressing rural exodus. This contributes to a significant spreading of slums on the fringes of cities and expansion of self builds because of the local populations' lack of income. Thus, in many of these countries, the informal sector of construction is more preponderant than the formal sector. The gap is widening between professional industry and self construction. Moreover, the formal sector does not take into account the technical and economic potential of local materials, including earth. An enormous amount of outreach work and training in the professional sector of construction must be initiated and intensified. This was particularly noted for Nigeria[8] but also concerns more and more developing countries.

- However, the opening of the formal business sector and increasing specific skills in construction and earthen architecture are greatly handicapped by the reality of "markets" deemed insufficiently profitable by building professionals, making it very difficult to opening the formal sector of construction.

- It seems that more universities are aware of the need to prepare the professionals they are training to carry out other responsibilities vis-à-vis their environnements[9], and of the technical shortcomings in the construction industry, and thus of the need for effective upstream training, in the curriculum, in order to develop earthen architecture. This awareness, from a general point of view, seems to motivate mobilization and institutional investments, which in some contexts, appear more substantial with proposals for integration of vocational training programmes. However, such mobilization and investment remain shaky, depending on the will of motivated people and volunteers, teachers, researchers and can be challenged by cyclical pressures, crisis situations (economic, financial), policies directing projects in other directions that may bear opportunistic antagonist tendencies against earthen architecture.

- With the proliferation of private universities that tend to recoup their investments, often by implementing a strategy of "clientelism" to an audience of upper class students, and often less engaged than public universities on the “societal” issues of architecture (access to housing the largest number in particular) and with an emphasis on formal and aesthetic "object" architecture (shape, facades) to meet the current international reference of large prestigious projects, the challenge is to persuade such authorities to be able to develop courses on earthen construction and architecture. The introduction of such lessons might meet temporary interests, but the effects of "trend ness" means that their long term durability remains highly vulnerable to the vagaries of the political climate.

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[8] **Odiaua 2010 :** ODIAUA, Ishanlosen – *Earth construction education : bridging the gap between traditional and professional construction knowledge in Nigeria*. Ibid, pp. 102-109.

[9] **Guerrero Baca et al. 2010 :** GUERRERO BACA, Luis Fernando, ROUX GUTIÉRREZ, Rubén Salvador, ARANDA JIMÉNEZ, Yolanda – *Arquitectos de tierra. Hacia una nueva formación de la arquitectura en México*. Ibid, pp. 110-116.

- It is important to consider education in light of three questions: 1: what do we learn? (content); 2: How does one learn? (methods), 3: where do we learn? (place). Nearly 70% of what we learn is acquired informally. Education is a continuous process that develops throughout life. This observation shows we must simultaneously design and develop formal classroom education (schools, universities, training centers) and on-site training in the field, interacting with professionals. This on-site teaching process on site must be "accompanied" (teachers, trainers, professionals)[10].

- Historically, in some contexts, the educational development of earthen construction has been based on the interest of geographers, architects and archaeologists to study and research on the built vernacular heritage or ancient sites. Other disciplines such as ethnology have completed these scientific studies. These studies have expanded this scientific interest to materials and construction techniques, as new concerns for the restoration / rehabilitation of heritage buildings or the conservation of ancient sites emerged. These trends were particularly followed in European countries, starting in the 1950-60's, thus paving the way for educational activities in the 1980s, and depending on the country where the role of scientists (archaeologists) could have even been decisive enough to stimulate a revival of contemporary urban architecture[11]. This shows the importance of giving credence to the study of old buildings, which could eventually be a catalyst for education and vocational training. Such a catalyst can then prove its worth when the architectural heritage in turn becomes an economic interest likely to generate a more structured and lucrative market (restoration / rehabilitation and development) which can take up professional skills (business, craftsmen).

- In specific contexts, international events like the conference TERRA 93 in Portugal have played a very active role in initiating a more structured process of conservation of earthen architectural heritage, paving the way for a new dynamic in the civil construction sector, and establishing a training programme for professionals, aspiring entrepreneurs and artisans (Serpa school). This impulse was then taken over by the creation of a national association, the Centro da Terra (CdT) and some universities have organized scientific events (ATP[12] seminars) enabling real knowledge production and giving more institutional visibility and media attention to the subject of earthen architecture[13]. The synergy between the academic and professional sectors, although not easy to establish, may prove to be very promising.

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[10] **Dardes 2010 :** DARDES, Kathleen – oral presentation during the seminar TERRAEducation 2010.

[11] **Fernandes 2010 :** FERNANDES, Maria – *Arquitectura de tierra en Portugal, capacitación y enseñanza : veinte e cinco años de experiencia.* pp. 218-229.

[12] Earthen Architecture in Portugal.

[13] **Fernandes 2010, Ibid.**

- The interface between public universities and the vocational training sector is still underdeveloped, but appears to be a greater concern for some institutions. This can be facilitated by the relationship to an NGO (Brazil[14]), or by establishing links with industry and building trades (Nigeria[15]) interested in establishing a new market stimulated by the promotion of more "modern" materials and methods of construction as the CEB.

- Over recent years, the establishment of specialized education programmes essentially addresses three main motivations: 1: Help maintain the cultural diversity of territories and management of their architectural heritage; 2: The development of social housing for the poor 3: Facilitate the development of a sustainable eco-habitat that will help preserve the environment. These three motivations were strongly supported in the developed countries and are now being implemented in developing countries. Broader, large scale areas of concern, such as sustainable development issues and environmental architecture, are the pillars encouraging the establishment of specialized education and starting a process of consolidation in the training curricula of institutions (South Africa[16]).

- In some contexts[17], strategies have been proposed to reduce the gap between earthen architecture and its education: 1: develop a transversal approach between art, design project, technology and economy, or between architecture, science and art[18] ; 2 - Promote earth as a viable alternative because it is in many situations the primary material available and still affordable; 3 - develop better institutional cooperation; 2: better adapt architectural design to the material properties; 3: Update the curriculum; 4: Train teachers about the recent advances in the field; 5: Introduce all aspects of earth building models in modeling architectural and structural engineering courses.

- While a few specialized centers or institutes on earthen architecture were founded over the last decades of the twentieth century[19], putting their efforts on developing integrated education, such instances remain rare. But other more recent initiatives seem to have undergone a consolidation phase as new projects emerge. This is the case of Argentina, with the creation of the "Centro Regional de Investigaciones de Arquitectura de Tierra Cruda" (CRIATIC[20]) at the Faculty of Architecture and Urbanism of the National University of Tucumán, that began in 1997 with the establishment of the first specialized activities. More recently, CIPTEV[21], founded in Mexico (Zapopan) in 2003-2004, the Institute of Clay Construction (EIK then TERRAKorea) South Korea, founded in 2006, the National School architecture of Fez, Morocco, with the establishment of an education pole in Marrakech, PATerre[22] (2006). The situations are different when these entities are linked to a university or a faculty / department, or if it is private (foundation, institute), especially because of the human and material resources that are provided.

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[14] **Nogueira e Taveira 2010 :** NOGUEIRA E TAVEIRA, Eduardo Salmar – *Sistemas constructivos III : Mano al obra*. Ibid, pp. 76-81.

[15] **Isa et al. 2010 :** ISA, Abdul, ADOKE, I.I., UMAR Abdullahi, SADIQ, Y.O. – *An evaluation of teaching and professional training curriculum in earth construction technology of Abubakar Tafawa Balewa University, Bauchi, Nigeria*. Ibid, pp. 96-99.

[16] **Bosman 2010 :** BOSMAN, Gerhard – Sustaining sustainable construction in higher education curricula. Ibid, pp. 158-166.

[17] **Odiaua 2010.** Ibid.

[18] In France with the festivals « Grains d'Isère » that have been organised since 2002, each year at the end of May at the « Grands Ateliers ».

[19] CRAterre at the School of Architecture of Grenoble in 1979, the Auroville Earth Institute, in India, in 1989.

[20] **Mellace 2010 :** MELLACE, Rafael Francisco – *La enseñanza de la construcción con tierra cruda como alternativa tecnológica y arquitectónica ; una experiencia regular en la Universidad Nacional de Tucumán, Argentina. Centro Regional de Investigaciones de Arquitectura de Tierra*. Ibid, pp. 68-75.

[21] Centro de Investigación y Producción de Tecnología Ecológica para la Vivienda, fondé par l'architecte Elena Ochoa Mendoza.

[22] **Tayyibi 2010 :** TAYYIBI, Abdelghani – *Promotion de l'architecture de terre au Maroc par la formation et la recherche*. Ibid, pp. 90-95.

- Rare are the specialized centers that deploy a wide range of synergistic activities in order to have a greater impact on their environments. The example of the Auroville Earth Institute, India, which combines training / education, applied research (materials, technology), publishing, consulting and deployment of international activities of architectural projects in the world is, in this regard, remarkable[23].

- In some countries (Republic of Korea[24]) we can see an original strategy to promote earthen architecture based on the establishment of a Professional Institute (associative structure) that coordinates the deployment of various activities: higher education, vocational training, public awareness and education, and research projects, plus summer workshops, organization of fairs, exhibitions and architectural competitions. This program is developed in synergy with the university, a research laboratory and private sector businesses and artisans. This interface between the public sector, academia and the private sector is a very promising trend that should be further developed. Other organizations support a strategy along the same lines[25].

- Students' interest for earthen architecture and construction seems to be growing, motivated by environmental and social issues. However, still mostly trained in academic settings that maintain an emphasis on modern materials and architectural expression, these students must regain confidence with the material and techniques used in earthen architecture. This is what some teachers are working on (Brazil). For this, the didactic and pedagogical methods that are generally fairly mobilized combine the theoretical and practical through the manipulation of materials and experimentation in construction. This policy also addresses the desire for practical training that is on the rise, as can be seen in some other countries[26].

- Education programmes still appear to focus on the acquisition of technical knowledge (construction technologies, building systems, components, construction, architectural project) but remain based on a foundation of historical and cultural references. Interfaces with the field of humanities and social sciences still seem limited while a multi and interdisciplinary approach is necessary given the complexity of growing problems in managing the need for better social, economic and environmental settlement and habitat projects.

- Social resistances opposed to the renewal of earth architecture seem to be mitigated by developing a teaching strategy, implementing experiential learning methods on concrete projects. This strategy is put forward in some contexts.[27]

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[23] **Maïni (Satprem) 2010 :** MAÏNI, Serge (Satprem) – *Education activities of the Auroville Earth Institute*. Ibid, pp. 117-123.

[24] **Hwang et al. 2010 :** HWANG, Heyzoo, KIM, Soonwung, CHO, Minchol – *Educational activity and prospects of the Earth Architecture Institute of Korea*. Ibid, pp. 58-67.

[25] **Moreno et Moreno 2010 :** MORENO, Jesus Antonio, MORENO, José Raul – *Estrategia de apropriación social de la tierra cruda para la arquitectura mediante la transferencia de conocimiento en obra y el aprendizaje experimental.* Ibid, pp. 230-237.

[26] **Fernandes 2010**. Ibid.

[27] **Moreno et Moreno 2010.** Ibid.

- In academia, the tendency is ever more divided between teaching practices which emphasize practical learning, and a more "heuristic"[28], experimental approach. This trend remains hampered by the lack of human resources (teaching teams unconsolidated) and material resources (within budget and infrastructure).

- Still rare are the institutional programs in higher education that, in universities and their faculties, their architecture departments (and even less in their engineering and civil engineering departments), offer theoretical training modules or units in the curriculum (usually over five years). However, the integration of training programmes in the first cycle (Bachelor) can become a springboard to more comprehensive programmes. This is the case for DOA-MNU at the University of Mokpo (ibid), in Korea, but on a limited time schedule (80 hours). This is also the case for CRIATIC in Tucumán, which offers a structured learning programme throughout the "grado" cycle with a similar hourly charge (72 hours). These theoretical lessons are complemented by architectural project workshops, and practical site or field activities, construction site visits and community project participation related activities.

- The integration of a foundation course on earth as a building material, as well as on other building materials, as early as possible in the curriculum, could provide an opening for students on issues of earthen architecture. Ideally this foundation course would be followed by all students in the form of compulsory education.

- Other universities offer elective courses that can be the basis for a future institutional consolidation of initial training curricula.[29]

- The implementation of new postgraduate professionalization courses, on continental or regional scales, except for the DSA earth architecture programme offered by CRAterre at the National Superior School of Architecture of Grenoble, has not progressed. This confirms a large gap in political, institutional and economic support for institutions of higher education, although there is progress with the development of "modules", "sessions" and "options", in basic cycles of training. However, in India, the Auroville Earth Institute[30], to address the shortcomings of national universities in the area, plans to implement an ambitious programme of postgraduate courses for architects and engineers, as well as a degree programme for both trained and untrained technicians. This programme will require significant human, material, and financial means as well as infrastructures.

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[28] This term of scientific methodology is qualifying all intellectual tools, all processes and more generally all approaches that are favouring the discovery – this is the Greek root of the word – or the invention in sciences (reference : Encyclopédia Universalis). In our field , the heuristics of experimentation is favouring the discovery of the matter, the materials, the structure, the space and the shape, and the practical appropriation of the knowledge. It feeds the « thinking » of the project while favouring the innovation in construction and architecture. See also **Houben 2010 :** HOUBEN, Hugo – *« ExploraTerra » un module d'enseignement innovant pour la didactique de l'architecture de terre*. Ibid, pp. 188-197.

[29] **Guerrero Baca et al. 2010.** Ibid. Le cas de la Faculté d'Architecture, Design et Urbanisme de l'Université Autonome de Tamaulipas, au Mexique.

[30] **Maini 2010.** Ibid.

- In most contexts, there is still a huge need to satisfy the provision for educational materials, certified courses and systems of validation of competences in different levels of academic and professional education.

- Current research and teaching teams still suffer from a great shortage of means: lack of consolidation and high personnel turnover resulting from a lack of prospects for personalized teaching and research projects due to the limited budget and infrastructure offered by their institutions. When facilities do exist, they are sometimes underutilized (Brazil[31]). Resources allocated to these teams are still limited, with a constant need to negotiate or struggle to maintain precarious situations.

- The notion of separation of disciplines has been evoked, notably between architecture and specialized disciplines such as engineering. When the necessity arises for high environmental quality architecture that respects the imperatives of social and economic accessibility, then harmonization of disciplines, better team work, and the installation of new tools for integrating design knowledge of environmental engineering and other specialized knowledge (social sciences), becomes crucial. This perspective brings important changes in teaching practices, particularly in the teaching of the architectural project. Earthen architecture, its cultural evolution in the current landscape and future of architectural production, is directly involved in this necessary dialogue between languages, knowledge, practices and cultures of developing projects, and particularly between architects and engineers, but also the social sciences. Thus, a multidisciplinary approach becomes a key question.

- This necessary change becomes even more pressing when new energy regulations (mainly thermal/energy performance regulations) must be taken into account. To date, however, the databases dealing with earthen materials for building are not comprehensive enough to be useful to project developers. Much work is needed in this area. Moreover, new low emission design modes in architecture take a decidedly technical approach that does not take into account the social, economic, cultural dimensions, veritable pillars of true sustainable development. The scientific and professional community working in the field of earthen architecture should contribute to the production of reference documents that expand the criteria to be considered.

- New experiments in the integration of courses for energy sustainability facilitate the consideration of earthen materials and the potential of earth architecture. The case of an academic cooperation agreement between MIT (Massachusetts Institute of Technology) in Boston in the United States, and the University of Coimbra, Portugal, allowing the development of a common curriculum, was noted.[32]

- The mobilization of NGOs appears increasingly significant, and more projects are developed in conjunction with local communities by integrating vocational training sessions on pilot sites, training sites, or in conjunction with organizations to which they bring their support.[33]

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[31] **Nogueira e Taveira 2010**. Ibid.

[32] **Fernandes 2010**. Ibid.

- Teaching and research units deploy more transfer and technical assistance activities, in connection with public or private organizations, NGOs and local communities, or through agreements with municipalities and other local authorities. This is the case for several participating institutions in Latin America (Argentina, Mexico, Colombia[34], Brazil, Uruguay[35]) and in Africa (Nigeria, South Africa). These programmes incorporate professional practice for students, in conjunction with local communities (South Africa[36]; Argentina[37]) and lead to the achievement of innovative social housing prototypes. This opening to partnerships and the concrete results in terms of innovation have a strong educational impact on students but also on the technical teams of partner organizations and the inhabitants themselves. These activities stimulate the development of various types of participatory self-building practices.

- In other countries, although there is a traditional earthen construction culture, now endangered due to the increasing use of industrial materials and the popular rejection of earth (generally perceived as an obsolete material), even though earth construction could be an alternative for greater access to housing, education and research in this field have great difficulty to grow. The lack of government interest and the lack of means in academic institutions call to deploy other strategies in link with other partners such as NGOs, and to seek support from the international academic and scientific communities. The setting up of international partnerships needs to be reinforced.[38]

- In current applications of earthen architecture, particularly in the social housing sector, there is a lack of creativity, and a seeming inability to disengage from traditional models. In this sense, education is directly challenged in order to generate new concepts and architectural models, but more broadly in order to reconsider new approaches to low-cost social housing projects. The need to improve the architectural quality of low-cost earthen habitat projects[39] has been deemed essential to developing new, more rewarding architectural expressions and help to save earthen architecture from the stigma of traditionalism, poverty and mediocrity that remains very detrimental in most contexts.

- The lack of knowledge about earthen materials and their use in construction and architecture, poses serious problems for the conservation of earthen built heritage. Still, too few educational programs address the issue of conservation, which only widens the gap between cultures, traditions and modernity. This can be particularly acute in some countries.[40]

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[33] Among the numerous Ngo's we have to point out here the support of the German Ngo Misereor to numerous projects that are carried out in African and Latino American countries which are contributing to the strengthening of vocational training centres and also to the setting of specialised curricula un university contexts (the case of Angola).

[34] **Moreno et Moreno 2010**. Ibid.

[35] **Etchebarne Scandroglio 2010 :** ETCHEBARNE SCANDROGLIO, Maria del Rosario – *Programas de formación en arquitectura de tierra en Uruguay*. Ibid, pp. 124- 127.

[36] **Bosman 2010.** Ibid.

[37] **Sosa et al. 2010 :** SOSA, Mirta Eufemia, LATINA, Stella M., MELLACE, Rafael Francisco – *Enseñanza de la arquiotectura de tierra en la formacción de grado*. Ibid, pp. 82-89.

[38] **Islam 2010 :** ISLAM, Mohammad Shariful – *Present status and problems of earthen architecture in Bangladesh : role of education*. Ibid, pp. 176-184.

[39] Isa et al **2010**, Ibid.

- Original initiatives for the enhancement of architectural heritage, including vernacular housing, aim to instill in students a new perception of local building cultures and to sensitize them on the risk of loss of such culture. These approaches value the salvaging of materials and traditional techniques, in connection with the issue of rehabilitation of vernacular architectural heritage[41].

- Some institutions work toward the development of synergistic partnerships, nationally and regionally, as is the case in Argentina with the CRIATIC, which brings together the National universities of Tucumán and Buenos Aires on joint activities, and also the University of Salto in Uruguay and the University of Santa Fe, also in Uruguay (setting up of the group FRONTERRA)[42], organizing regional courses. These networked efforts give more visibility to the actions undertaken and stimulate collaborations that will help to overcome challenges linked to the positioning and identity recognition of institutions, while deploying another scale of mobilization of human and logistical resources.

- The development of exchange networks of and the sharing of information (lists on the Internet), at the national, regional or intercontinental levels, reflect an advanced stage in the organization and a real commitment to coordination. By accepting a wide range of active members from a variety of entities, as well as the general public, these networks become pressure groups or “lobbies” that help give more academic, scientific and social visibility to the promotion of earthen architecture. Such networks are stronger when they include a Scientific Council that grasps the opportunity, during international events (conferences, seminars, workshops), to meet and develop guidelines for priority action plans in the short or middle terms[43]. Other scientific events, such as the first Mediterra Conference held at the University of Cagliari in March 2009, organized in partnership with the UNESCO Chair “Earthen Architecture”[44], contribute to the emergence of other regional networks[45]. However, these networks operate mainly through the efforts of their volunteer members, and struggle to find ways to develop real synergistic partnerships and to implement joint activities, in spite of an ever-growing demand. Setting up projects in partnership, in response to regional and even continental calls for projects, can contribute to reach new levels of structuring and effort coordination.

- Despite difficulties to implement action plans that may result from coordination efforts within networks or following expert seminars, such plans can provide a clearer view of the situation in the field, useful to further reflect on key issues shared by the scientific, professional, and academic communities, and better define priority needs in terms of research and training[46]. But only an actual capacity to form partnerships to set up joint projects supported by suitable means may be guarantee the initiation and implementation of concrete projects.

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[40] Ibid.

[41] **Soria López et Guerrero Baca 2010 :** SORIA LÓPEZ, Francisco Javier, GUERRERO BACA, Luis Fernando – *La Arquitectura de tierra en la enseñanza del diseño y reutilización arquitectónica en la UAM-XOCHIMILCO*. Ibid, pp. 137-145.

[42] **Etchebarne Scandroglio 2010.** Ibid.

[43] We refer to the regular meetings that are held by the Ibero Amertican network PROTERRA, during the SIACOT seminars, and also to the meetings of ICOMOS-ISCEAH (International Scientific Committee of Earthen Architectural Heritage) that are held during the great international conferences « TERRA » or associated to other favourable opportunities allowing to gather the committee’s members.

[44] Dipartimento de Architettura de l’Università Degli Studi de Cagliari (UNICA), Italie, Escola Superior Gallaecia de Vola Nova de Cerveira, Portugal et CRAterre de l’Ecole Nationale Supérieure d’Architecture de Grenoble (ENSAG).

[45] **Achenza et al. 2010 :** ACHENZA, Maddalena, CANCINO, Claudia, CORREIA, Mariana, FERRON, Amila, GUILLAUD, Hubert – *Experts workshop on the study and conservation of earthen architecture in the Mediterranean region*. Ibid, pp. 148-157.

- Generally speaking, the integration and development of specialized training courses on earthen construction and architecture is in conflict with the centralized control of academic standards, which make it very difficult to develop and implement new curricula.

- The interface between teaching and research explicitly defines the main mission of higher education institutions. This interface is activated when we observe the tangible benefits of research on teaching, enriching the development of educational content, educational materials as well as teaching methods and practices. The presentation of the teaching module "ExploraTerra"[47], established in the framework of the DSA-Terre of Grenoble, is the result of the research programme “Grains de bâtisseurs”® (Builders' grains) and clearly illustrates this interface between research and teaching. The proposed didactic analysis shows the strength of a new heuristic pedagogy that not only allows the acquisition of knowledge but also its structuring, and a pedagogy based on maieutics that supports students during their learning journey through experimentation. This represents a significant evolution towards a new didactic engineering that helps to reinforce earthen architecture in its status as a discipline in itself.

- The emphasis on research, simultaneously with the development of specialized education which in all training cycles (Bachelor, Master, Doctorate), clearly reflects the will to consolidate the perennial institutional anchoring of earthen architecture in the university context. The strategy of approaching earth as a material on equal terms with other materials as well as to incorporate more specific research on earthen architecture in a wide range of issues (heritage conservation, eco-housing) proves more effective in several contexts.

- Similarly, the strengthening of interdisciplinary and transdisciplinary approaches, the efforts focusing on the establishment of partnerships on national and international levels (Europe), but also the dissemination of learning and knowledge derived from research through the organization of conferences, workshops, seminars (ATP and SIACOT[48]), the existence of a "project" supported by publications both scientific and aimed at the general public, have yielded results. This contributes to the recognition of centers of higher education and scientific research by national and international assessment structures. The work undertaken by the Escola Superior Gallaecia of Portugal and its research center CICRA over the past decade is a good illustration of this[49].

- It is also important to facilitate and expand the sharing of resources and knowledge. For this, the use of new communication technologies is emerging as an essential tool (Internet blogs and forums)[50] but again, this requires substantial human resources, beyond the involvement of volunteers (Proterra and Arqui-terra, lists for example).

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[46] Ibid.

[47] **Houben 2010, ibid.**

[48] Seminars Earthen Architecture in Portugal and Ibero American Seminars on earthen Architecture organised by the PROTERRA network.

[49] **Correia et al. 2010 :** CORREIA, Mariana, CARLOS, Gilberto, MERTEN, Jacob, CORREIA, Rui – *Research and education at Escola Superior Gallaecia, Portugal*. Ibid, pp. 167-175.

- Reference was made earlier to the need to develop partnerships between academia and the private sector of the construction industry[51] and to the emergence of projects that follow this direction[52]. This requirement addresses both the obligation to have more resources but also that of promoting a shift towards research and development (R & D) conducive to technological, architectural and innovation in construction. Sustainable development and social issues that call for the production of a new "eco-sustainable earthen architecture" integrating knowledge of environmental engineering and new bioclimatic energy technologies, the necessary evolution toward a better and more affordable habitat (social issue), and their integration into a "market" both sufficiently promising and lucrative for formal construction (economic issue), lead us to rethink the research practices of education through the prism of R & D. This is perhaps one of the conditions necessary to meet the challenge of sustainable development. Attendance to the *Grands Ateliers de l'Isle d'Abeau* during TERRAEducation 2010, during the last phase of development of the prototype solar house called "Armadillo Box" ® prepared for the Solar Decathlon Europe competition in Madrid (June 2010) , reflected this new approach in experimental development on innovative prototypes. It was conducted on the basis of a project designed by second year Masters' students from ENSAG, in an interdisciplinary partnership (architecture and engineering) between industrial, regional, national and European entities. This type of approach to the interface between teaching and research, the public and private sectors, sets up genuine R & D in architecture, contributing to activate an enormous potential for development through experimentation, and should be more widely developed.

- In some situations, the development of vocational training leads to significant advances that result from long-term investment. The case of the Auroville Earth Institute, already mentioned, shows that the proposed training activities cover a wide range of skill levels (students, architects, engineers, project managers, technicians, artisans) and the duration of these courses can be adapted as needed, according to means and availability, ranging from days to a week or several weeks or months. A variety of training offers appears to be a key factor in obtaining meaningful results and an increased impact on local populations and on the development of professional skills. But, beyond the voluntary efforts made, the sustainability of such curricula requires the mobilization of enormous human, financial and material means. Moreover, the issue of awarding diplomas from such institutions, more "private" than public, after training, will provide challenges and raises the question of establishing a partnership with a university[53] or public institution of higher education, or another entity accredited to do so.

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[50] Ibid.

[51] **Avrami 2010.** Ibid.

[52] **Hwang et al.** 2010. Ibid.

[53] **Maïni (Satprem) 2010**. Ibid.

- The key issue of validating and certifying skills has been approached mainly through the prism of the European situation [54 and 55]. In Germany, courses recognized by the Chambers of Commerce and Handicrafts may deliver a "specialist in earth construction" certificate This certification allows the registration of craftsmen trained in the professional register of those organizations, and contributes to legalize the status of professionals in relation to the public authorities and customers. Such arrangements promote the recognition of earthen construction trades.

- On a European level, a pilot training program under the name of "Leonardo da Vinci"[56], focusing on clay plaster (2002-2005), bringing together six European countries, prolonged into a second stage (2005) with the program "European Earth Builder", expanded to three more countries in Eastern Europe, and was used as a springboard to launch a third phase of the project "Learn with earth" (2007-2009). This third phase allowed to set up an ECVET system (European Credit Transfer System in Vocational Education and Training) of learning credits in the field of earth construction. Initially, this system is restricted to clay plasters, a field that promotes skills and trades, as it responds to a public enthusiasm for earth-based finishing and decorating, a new growing market of interest to the formal sector of the professional building economy.

- Public and media education and outreach about earthen architecture can advantageously be based on operations such as festivals, exhibitions and national days, or even international days, devoted to the promotion and valorization of earthen architecture. Festivals such as "Grains d'Isere", held annually in the *Grands Ateliers de l'Isle d'Abeau* (Great Workshops of l'Isle d'Abeau) since 2001[57] and the *Jours Européens de la construction en terre*[58] organized in several European countries since 2005, as well as similar venues organized in other countries, are all events that can promote better societal support and engagement.

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[54] **Schroeder et al 2010 :** SCHROEDER, Horst, RÖHLEN, Ulrich, JÖRCHEL, Stephan – *Professional Training and Academic teaching in earth building in Germany*. Ibid, pp. 128-136.

[55] **Didier et al. 2010 :** DIDIER, Lydie, DOULINE, Alexandre, HERZ, Uta – *Cap sur la terre : le système ECVET Construire en terre pour se former en Europe*. Ibid, pp. 210-217.

[56] **Herz 2010 :** HERZ, Uta – *European networking for vocational training and education in the earth building sector. Actions by « Lehmmuseum Gnevsdorf » and « Europâische bildungsstâtte für lehmbau » / Fal e.v.* Ibid, pp. 200-207.

[57] In the frame of a project which is carried out with an association gathering 48 communities of North Isère, directed by CRAterre-ENSAG. This project undertakes sensitization activities for scholars and creative workshops, teaching and applied research activities with students in Master and DSA-Terre courses.

[58] **Herz 2010**. Ibid.

3 - WORSHOP RESULTS AND REFLECTIONS

3.1. – Workshop 1 :

Revision of the types of curricula of higher education and vocational training, teaching and learning methods: trends and adjustments necessary to the expectations and needs of society.

Participants : Isa Abdul, Umar Abdullahi, Claudia Cancino, Kathleen Dardes (moderator) David Gandreau (rapporteur), Philippe Garnier, Hugo Houben (moderator), Thierry Murat, Islam Shariful, Horst Schroeder, Francisco Javier Soria López.

The first workshop focused primarily on the challenges that education and vocational training should strive to meet, such as the need for change and adaptation of teaching practices.

Current status of "specialized" education : findings and questions

First, it was noted that earthen architecture has undergone considerable development in recent decades. Today, we can identify the existence of specialized courses in universities, polytechnics, vocational training centers, as well as in organizations dedicated to training (associations, NGOs...) that are not in any way linked with "institutional" education or training entities.

All levels of education are covered: the accompanying training of self builders and communities, different levels of training for artisans, technicians' certificates, bachelor degrees, masters and doctorates in university. Similarly, specialized training has diversified into a wider range of disciplines: construction and engineering, architecture, urban planning, archeology, conservation. However, there is wide variation in different contexts and in particular between the levels of "professional" and "academic" training. Sometimes neither one nor the other are available yet, and so it is the “informal” learning that dominates.

Another notion that this workshop has revealed may be described in one word: INFORMAL! Workshop participants estimate that nearly 80% of earthen constructions are the result of self-build, principally housing. This observation corroborates the fact that overall, the aquisition of construction skills remains too informal in a large majority of contexts, with rates that can not be precisely evaluated but are probably very high, perhaps 60 to 80%. Certainly, no less than 30 to 50% of these buildings are built of raw earth mainly by a population of "informal artisans". Thus, these structures result from the application of knowledge and practices that are transmitted in a replicative way, without re-questioning, and reflect evidence both of skilled know how as well as gaps and deficiencies in the application of such skills. How can we facilitate the development of a more formal training process for people who work principally informally? Therefore, if we pursue the development of a more institutionalized teaching in universities and training centers, then not only must the teaching of earthen construction and earthen architecture must become more formal, but evaluation and validation criteria must be established in order to address gaps and deficiencies observed in informal production. However, depending on the context, intermediate solutions between the totally formal and totally informal are needed. Depending on different contexts, there are still large gaps to fill between the levels of certifications and degrees, and between the evaluation systems. If more "formality" is sought, which involves strengthening academic systems, then what role might the university play in this development? Furthermore, how can we enable a better introduction of formal education on earthen architecture and construction in the university context, without achieving its recognition as a "discipline" in it's own right?

The evolution of informal knowledge and practices into formal knowledge and practices must also allow the evaluation of acquired knowledge and skills based on comparative analysis of quality of expertise, applied practices, and quality of productions / accomplishments, for both informal and formal systems. This shift from the informal to more formal becomes all the more necessary as we try to develop “trades" specific to earthen construction and architecture that can be applied to local and regional scales, and for which separate educational content must be developed and offered to society. The question is then, what does society need? More specifically, which trades does society need? Do we need to train architects, engineers, planners, contractors and specialized trade crafts persons? But also policy makers, future leaders of international governmental and nongovernmental organizations? Do these trades match the expectations and needs of people engaged in mostly informal construction, in different contexts and that can hardly, if at all, afford the services or their skills? How big would the "market" have to be in order to be viable for those who specialize in earthen architecture and construction, and allow them to flourish? Do these populations not have a greater need to organize amongst themselves in order to train themselves? And what about the role of universities and professional "specialists" in this perspective of "coaching" and development of education and training? In order to create a true dynamic market which will lead to a myriad socio-economic solutions, wouldn't the real issue be to improve and accompany the informal sector through its progression and qualitative leaps in development?

Needs and expectations of society:

We can not hope for progress in knowledge and practices, for the qualitative and quantitative problem-solving capacity of training options, unless we clearly assess the expectations and needs of society and local populations in connection with different geographical, social, economic and cultural contexts, but also taking into account training structures and actors, "trades" and skills to be taught, theoretical contents, practical curricula and teaching methods best suited to the formalization of these trades and skills, and finally, the "market" for training activities.

However, there is a huge market in several regions of the planet, such as India, China, the Emirates, in most African countries and in Latin America. These markets cover the production of housing, as well as the conservation of architectural heritage or housing rehabilitation. There are huge "opportunities" to work. But these markets have not been specifically evaluated, hindering economic investment for the development of earthen architecture from both governments and industrial enterprises (SMEs and SMIs in particular). Furthermore, inadequate dissemination of knowledge to motivate people to undertake specialized training courses, and thus, as a consequence, insufficient skills, further weigh down the socio-economic disadvantage. Thus, the curricula must be adapted to the integration of perspective "markets", depending on various contexts, and also contribute to the development of these markets. For this, the "professionalization" of trades, able to broadcast quality productions, is essential.

When referring to the investment for the development of earthen architecture, it must be understood that this investment must extend to social, economic, and environmental aspects. Viability of an investment requires us to recognize the importance of education and training to generate trades and skills that companies and markets need, to generate employment that contributes to a more substantial and even to a massive development of the earthen architecture market. Supporting the development of such a market also means better assessing the amount of individuals "in training", as well as the institutions or structures and the education and training staff involved in such prospects.

This will help to better appreciate the efforts that must be put forward but also to better support the integration of a process of training for a public that seeks training in the domain, including individuals that may be unemployed, people who are already graduates yet who are unable to find opportunities for employment in spite of their diplomas, or people who question their own career paths and adhere to the proposed training offers, in tune with the European principle stating that training can develop over the course of a lifetime. In light of these considerations, it is not only the supply of training programs that is being questioned - and which must be evaluated - but also the mechanisms set up by education policies favoring "bridges" between degrees and between disciplines.

If we admit that earthen architecture is increasingly being recognized and better accepted by society, then it becomes essential to develop strategies to introduce the discipline in academia. It is therefore clear that curricula must also change. It is by constructing the framework of the discipline that we can meet the needs and expectations of society in connection with the field and to integrate a population in seek of training. For this, it should be better to seize the political, social and economic “opportunities”, or even the “wills” of particular individuals or groups of people (teachers, associations) who are trying to promote a project of an academic nature.

The importance of the diversity of contexts:

The installation of “ideally dimensioned” educational systems for teaching earthen architecture is probably not feasible due of the diversity of cultural, political and economic contexts, and the variety of societal trajectories in the field of education. Nevertheless, we must strive as much possible to attain this ideal dimension, in accordance with the diversity of contexts. This can be constructed by analyzing and comparing firstly the "portfolios" on earth architecture experiences available at representative institutions in different contexts.

A proper contextualization of formal education in earthen architecture offers guarantees of success in the development and consolidation of academic initiatives. To this effect, a thorough analysis should be made of the underlying social, economic, environmental causes that form the basis of feasibility for educational projects.

Curriculum design and development:

The curricula integrated in formal institutional environments should include specific goals, objectives and educational content that meet international standards and codes. Such international frameworks of reference are yet to be defined and should be sufficiently "flexible" to adapt to the diversity of contexts and to the periodically "shifting" educational priorities. However, it is desirable that there be the tendency, "globally", to work toward the international harmonization of standard system "bases" such as the assessment of learning, skills and competencies, and of systems for validation through "credits".

A review of all currently existing standards and systems should be performed to redefine these baselines. This could be easily carried out in the European context, for example, with reference to the European Qualifications Framework (EQF) and the European Credit System for Vocational Education and Training (ECVET). This may be more difficult for regions where there is a diversity concerning these frameworks and credit systems applicable in different nations. Moreover, in any context, it is important to give clear visibility to earthen construction as being part of the specific fields of education and vocational training.

In the design and development of curricula, the share of theoretical and practical teaching will inevitably vary according to geographical contexts and the different categories of professions that are covered. Another factor would be "educational culture" contexts when one considers the great differences that currently exist between countries and regions worldwide. For example, it was noted that in Nigeria, university education is 75% theory and 25% practice, in most disciplines. For earthen architecture, in this academic context, a different balance between theory and practice should be promoted, including at least 50% practical learning.

Contents in education and training:

The aphorism of John FC Turner, "a material is not interesting for what it is but for what it can do for the society" remains relevant and effective. It highlights the importance of the "meaning" to be given to the development of the use of a building material, namely earth, in terms of its "utility" for society, for human development. It also reveals, implicitly, the importance of taking into account the social, economic, environmental and cultural issues that we have previously mentioned. And thus, the "sustainability" of educational policies that favor earthen architecture and construction, depending on different contexts. Thus, educational "contents", while taking into account the needs and expectations of local populations, should be flexible enough to guarantee their proper adaptation.

It is possible to point out specific aspects in educational programs that meet the needs and expectations of today's societies, in all their diversity. This possibility can be attested to by considering the ever growing global adhesion to the broad paradigm of sustainable development and to the societal responses to be found based on three pillars: social, economic and environmental, to which we can now add a fourth pillar, that of culture. This refers to the societal challenges that we must meet, which are more and more divided in terms of development: “human” (social), “material” (economic), “natural” (environment) and “cultural” (identities and diversity).

Regarding the field of earthen construction and architecture, several education and training “areas” are identified. Following are some that can be considered as shareable despite the diversity of contexts:

- knowledge of matter and materials: characteristics, properties, stabilization
- knowledge of use patterns and techniques;

- evolution of materials and techniques: earth-based eco-concretes;
- material production technology: machines, tools, etc..;
- construction and implementation;
- Life cycle analysis and energy efficiency: energy integrated production / construction / maintenance;
- traditional building cultures (knowledge and know-how) and cultural continuum: valuation, changes, adaptations, innovations;
- habitat and human and social "dignity": access to housing and to an improved living environment;
- "Eco-housing": bioclimatic architecture, thermal regulation and interior atmosphere; construction and reduction of environmental impacts: greenhouse gas emissions and other pollutions;
- "healthy" habitat and natural materials, local resource management;
- construction and recycling;
- innovative construction and architectural design, experiments and prototypes
- coated and decorated surfaces, exterior and interior decoration
- earthen architecture, "local" sustainable development industries and local economies: entrepreneurship, work and employment;
- human settlements, urban planning and development of territories that promote local resources;
- conservation of built heritage: restoration and rehabilitation;
- conservation and development of cultural landscapes;
- heritage management, development and cultural economy;
- earthen architecture and natural disasters: earthquakes, hurricanes, floods, resilience of buildings and people;
- code of practice, codes and standards;
- quality approach: laboratory and on-site;
- ...

These specific areas in educational and training programs should be defined according to the different trades which academic institutions intend to specialize in and lead to the definition of specific programs, teaching methods and tools.

Teaching methods, teaching, pedagogy:

Faced with the challenges of contemporary society, the "areas" of educational content and training that have been identified are also to be linked to the development of research. Particularly with regard to the accompaniment of the evolution of building cultures and innovation in construction and architecture, which centers around experimentation and research & development (R & D), but also research didactics. Therefore, teaching methods, pedagogy, and teaching tools are inevitably questioned and must also evolve.

Didactic innovation has recently enabled the introduction of new approaches to develop an education for earthen architecture based on the identification and resolution of "problems". This kind of teaching, experienced in CRAterre-ENSAG (Grenoble, France), allows the formation of "critical thinkers" capable to contribute to innovation.

At the heart of teaching methods and the necessary changes these need to go through, traditional "face to face" teaching between teacher and student during a lecture seems highly questionable. Experimental lectures (interactive experiences), experimentation, a "hands on" constructive approach and experimental construction projects promote a better integration of knowledge and know-how, and a better development of problem-solving skills, and this applies to design as well as to construction. This priority towards “doing” leads to better articulation of disciplines and trades, to pose and solve trans-disciplinary issues. It now seems essential to restore a narrative analysis of these new learning experiences, to foster development of new pedagogies and teaching, through doing and experimenting.

The integration of socioeconomic evaluation methods can help take a more accurate measurement of the impact that construction and architectural design has on the social (work) and economic (cost) environments.

Moreover, it also seems important to validate the relevance of teaching and teaching methods at the interface of formal and informal systems, in recognition of mutual experiences, considering that there are positive aspects to both systems.

Another aspect was raised, that of interdisciplinarity. Education for earthen architecture, given the diversity of the range of application (from the material to urban planning) and the current societal issues and challenges (sustainable development) necessarily involves the design and definition of curricula that mobilize a wide range of disciplines and sciences: construction, engineering, architecture, arts, history and archeology, anthropology, etc., physical and chemical sciences of matter and materials, human and social sciences, environmental sciences, etc. Thus, the question of breaking down disciplinary barriers and sciences, specifically the connection between science and culture, is at the heart of the educational debate.

Educational tools:

Beyond widely tested and proven teaching tools, recent developments in teaching methods help to give greater room for new tools.

For theoretical teaching, it is very important to provide students with bibliographies and a corpus (including articles) of reference texts, but also of course texts. The distinction should be made between teaching materials concerning the "basics" to be transmitted, and "evolutionary" and flexible supports, adapted to changing knowledge. This sharing and transfer of information is now largely facilitated by the use of new information and communications technology (ICT). The use of PowerPoint presentations can be very inspiring for teachers and gives much flexibility but should not overvalue image at the expense of transmitting knowledge to students. This is also the case for the use of videos, but these new tools also allow a "narrative" sharing of experiences. The use of such tools should be further supported by interactive teaching: debates, group work.

Case studies, visits of existing buildings, heritage, and construction sites, help provide a more concrete approach to students and help develop analytical and critical thinking, while promoting a better integration of knowledge.

As far as teaching practices, pedagogy in workshops, experimentation sites, and pedagogical construction sites should be emphasized.

Conclusion: which strategies to disseminate earthen architecture education?

During this first thematic workshop, this issue could be addressed only superficially. Some major themes were identified, which require investigation:

- The introduction of earthen architecture as part of academic curricula and the development of a more formal education required to better define a "vision" for this prospect. For this, it is still necessary to specify and establish what decisive contributions higher education and vocational training can make to current issues and challenges of society, for the practical implementation of sustainable development in the major application areas concerned, such as the development of human settlements, the conservation and enhancement of cultural heritage, and the preservation / development / adaptation of identities and cultural diversities. Educational and teaching styles, methods and tools to implement should be given a closer look, while facilitating their integration into a wide variety of social, economic, environmental and cultural contexts.

- The constitution and recognition of earthen architecture as a "discipline" in its own right itself is a decisive stage.

- The potential for development of education for earthen architecture must be grasped by considering very specifically "how to go about it". This implies the construction of academic frameworks and the development of educational contents, methods and tools that support the teaching and learning developments needed to support the academic integration of this discipline.

- Initiatives of individuals or groups of persons accompanying this effort for the introduction and integration of earthen architecture in the educational environment, often remain "Trojan Horse" strategies, and should be more strongly supported, both politically and materially.

- Successful experiences with a certain success should be better valued, communicated and shared, within the international community of teachers and researchers. Education for earthen architecture must take a more rightful place in academic events such as seminars, conferences and congresses.

- The move towards a more formal education in earthen architecture is accomplished through public awareness campaigns, as well as by interventions in primary and secondary schools, through transmitting with as much clarity as possible what earthen architecture can do for society.

3.2. - Workshop 2

Workshop 2 :

Workshop 2:
Strategic directions for research and PhD: what research priorities to meet the expectations and needs of society?
Participants : Gerhard Bosman, Minchol Cho, Mariana Correia (moderator), Marcelo Cortes Alvarez, Laetitia Fontaine (reporter), Mauricio Ganduglia, Luis Fernando Guerrero Baca, Hubert Guillaud (moderator), Eduardo Salmar Nogueira e Taveira, Jenny Vargas (representing Clara Sanchez).

The second thematic workshop discussed the issue of research in its relation to education, the impact of research on the earthen architectural project, and their evolution. The distinction between basic research, experimental research, applied research, and research and development was raised but was not discussed further because the relationship between research and teaching was deemed more important to discuss in the time allotted to this workshop.

Levels and expectations for the development of research

- Initially, the work group identified different levels and expectations for the development of research:

1 – Levels:
- Improve the relationship between research and development;
- Aim for a practical application of research;
- Develop research related to teaching and learning in order to improve teaching practices and training.

2 – Expectations:
- Develop research to better meet the needs and expectations of society (responding to current challenges);
- Better integrate research in academic institutions and consolidate devices related to the courses at masters, post masters, doctorate and post doctorate levels;
- Better situate research in different contexts (country, regional and local levels).

Sectorization of disciplines

- The issue of zoning of the disciplines concerned in the field of earthen architecture poses an ever greater complexity (by virtue of the diversity and specificity of their scientific scopes, scientific languages and cultures; architecture, engineering, material sciences and materials sciences, social sciences) in designing and implementing earthen architecture projects. Indeed, current projects meet new challenges of society (in the fields of eco-housing, affordable housing and heritage), at various scales (from the material to the building, the city and territory). Thus, the necessity to encourage interdisciplinarity was raised, even transdisciplinarity, in order to bring out a new way of thinking through the project and incorporating a more holistic approach - not just technicist – which would imply the need to establish links between knowledge from different research results in different disciplines.

Impact of research on teaching and practice

- Other needs have been identified to better ensure an outgrowth of research on higher education, as in vocational training and project practices. Primarily, the need to publish the results and findings of research through publications, and broaden their diffusion through the Internet and multimedia. In addition, action must also be taken to support the need for systematization, together with a need to support coordination mechanisms, action plans, programs, projects and scientific activities to better avoid redundant human, financial and material resources. In short, better control the scattering of research whose directions are often too random, or redundant ("replicative" research not taking into account previous achievements because of ignorance of what has already been done). Properly reacting to these needs requires better identifying research priorities that result from clearly identified social expectation. Such information would be based on a variety of state of the art platforms, networks, exchange lists, and sharing of international scientific holdings accessible to consultation or even download. The creation of a high ranking scientific journal, recognized by the research community, is also a needed. However, the question is raised whether there currently is a sufficient critical mass of research units and researchers in order to feed such a project, requiring both high-quality content and format, but also a periodicity of two issues per year.

Difficulties in harnessing and owning research results

- Appropriation of research results and knowledge is hampered by difficult accessibility or inaccessibility. It is especially necessary to support research project methodologies and practices, and modes of intervention. Research should integrate the analysis and evaluations of reference projects, into a corpus to be built and updated. It must also allow a comparative approach, which can take both locally contextualized and global approaches into account. This multiculturalism can only be advantageous to innovation in the design and practices of projects.

More research in the humanities

- The need for more research in the field of humanities and social sciences (sociology, anthropology, economics, history of building cultures, ...) has been identified as a priority to support an investigation other than just technicist, and to promote a more Holistic interrogation on different scales (from the material to the territory). The idea is to develop research on both the tangible (materials, construction) but also the intangible (society, culture). This need joins the requirement of multi and transdisciplinarity that responds to changes in the degree of complexity in new approaches to the issue of sustainable development, both in the field of action of heritage and of human settlements, and to facilitate new project practices as well.

Research training through research and types of research

- Better training for research through research and the promotion of research among students is a major objective, aiming at encouraging teacher-researcher vocations and consolidate laboratories and research teams in higher education institutions, as well as assuring that the production of knowledge takes better advantage of advances in teaching contents and practices. For this, it is necessary to review training arrangements through research that are implemented in educational institutions, or are yet to be implemented, and more widely - and as early as possible in curricula – the methods that support these devices. This objective must be linked to the creation of individual bachelor's theses, master's theses, personal final "research oriented" dissertations, and to the establishment of research internships for students within research units. The dissemination of the methods and tools of scientific research is also a form of heuristic learning for students, step by step, to adopt a scientific approach and better support the possibility of initiating a doctoral research path.

- A more specific discussion focused on the issue of a better integration of scientific methods in the academic world by identifying several directions:

    - Integrate knowledge bases as early as possible (material, technical, cultural history); a reflection on constructive and architectural references (historical and contemporary); revisit and reinterpret the knowledge to innovate and introduce progressive complexity, year after year.

    - As early as possible, acquire research methods; apply these methods on exercises of progressive complexity; offer students writing exercises applying research methods and practical exercises involving the formulation of a questions and answer through experimentation.

    - Establish a dynamic connection between theory and practice; propose experimental lectures and experiments in the workshop (research by experimentation); amplify the didactic approach linked to the heuristic approach; diversify the scales of experimentation, from matter to construction.

- Research should be more strongly linked to field activities so as to better meet the needs and expectations of society. The connection between research, industry, businesses, local authorities and education must be strengthened. Meeting this new challenge would contribute to the growth and consolidation of a more readable and fruitful "market" for the formal production of the built environment. Earthen materials could then earn a better place, on a par with other materials, providing an alternative response to environmental, architectural and constructive issues and thus, better compete with other materials. This link with industry would also offer the possibility to obtain additional financial support for research (including doctoral fellowships) while public institutions (state, provinces, regions), undergoing financial crisis, may tend to reduce their support (although this is not the case everywhere). In this sense, without neglecting basic research (on matter and materials, in the fields of humanities and social sciences), it is important to make better use of research-related experimentation, research and applied research projects and development (R & D). The link with industry may nevertheless raise concerns on the issue of the confidentiality clause and the exploitation and valorization of research results, in some countries.

- On site experimental research changes people's knowledge and practices, and brings about the development of theoretical thought - and thus teaching content - as can be seen with the development of innovations in construction and construction techniques that combine earthen materials for other natural materials (wood, fiber) or modern materials (steel). This back and forth dynamic between the laboratory and the field (design and construction) must be encouraged as the new practices that derive from it, which should be more widely disseminated. Basic research on the subject of earthen materials (physical chemistry for instance) must be better integrated into the general context of scientific research, using rigorous methods imposed the same way and at the same level as research on other materials.

- It is very important that research is more 'situated', both in regards to research on matter and research on materials, as earth is very “versatile” (different properties depending on the site), also in the field of production of knowledge about physical situations (soil, climate), in connection with social, cultural and economic contexts. Taking this diversity into account is essential to ensuring contextual applications that better meet local needs and expectations. Contextualization is not inconsistent with the trend toward globalization, as each approach learns benefit from the other. The idea is to encourage the practical application of the phrase "think global, act local."

- Research on building cultures and traditional vernacular earthen architectures, both in the cognitive (knowledge) and practical (skills) domains, must not only be descriptive but should be able to help update the intelligence of cultures and the genius loci (spirit of place). This will foster a creative reinterpretation of traditions to constructively meet the new challenges faced by society in terms of urban and landscape architecture.

- It is becoming increasingly necessary to develop basic research on the cultural values of earthen architecture. Such multi and transdisciplinary research must be based on a thorough study of the tangible and intangible dimensions of heritage and culture, and their diversity. Knowledge gained from this research will advantageously fuel our vision of conservation and heritage valorization, such as our perception of local development in connection with human settlements and housing, by improving the link between tradition and modernity.

Workshop 2: conclusions

In recapping the workshop, the working group of the second workshop on research and education, although this may be redundant in view of what has been previously stated, has extracted the highlights on two issues considered essential: what research should be developed and how to go about it?

A first level of restitution has focused on the identification of priority research areas and scientific scope issues posed by the new social challenges, needs and expectations of today. The priorities identified relate to the following areas:

- earthen architecture and a "localized" sustainable development approach ;
- capacity to respond to climate change;
- response capacity to natural hazards (earthquakes, hurricanes, floods);
- contribution to the eradication of poverty and housing affordability;
- local economic development and earth construction sectors;
- the need to better link the three pillars of sustainable development, (environment, society and economy), and better integrate the other two pillars, culture and governance;
- tangible heritage (archaeological, architectural) and intangible heritage (culture and society), their preservation, conservation, maintenance and enhancement.

A second level of restitution focused on research priorities and transversal directions by identifying the following:

- promoting interdisciplinarity and interculturality;
- better understand earth as matter;
- establishing a comprehensive database on the energy performance of materials;
- systematic research on building cultures;
- analyzing the values of earthen architecture;
- addressing different scales of the architectural project: matter, materials, building, city, landscape and territory;
- promoting constructive innovation: hybrid materials and techniques;
- defining indicators of quality architecture;
- identifying indicators of integration to contexts;
- developing educational research to contribute to the evolution of teaching practices;
- developing research on methods of knowledge transfer practices in the field.

The last level of restitution sought to better understand the changes needed to better develop research by identifying the following directions:

- produce an updated index of current research: who does what?[59]
- support projects that integrate scientific experimentation at different scales: the from matter to building;
- expand the integration of research on earthen materials in universities;
- increase the critical mass of researchers, encouraging vocations by developing research-based masters and doctoral degrees;
- better integrate research in field projects;
- set up research projects related to the industry sector, businesses and local authorities;
- seek doctoral scholarships from the private sector;
- set Mundus masters and doctorate programs;
- respond to invitations to tender for regional or continental research with transnational partnerships;

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[59] It is possible to use two websites that have been created for disseminating information on research activities with bibliographies of published works or articles. Visit the site research.terra that has been set by the ICOMOS-ISCEAH Committee, and the site Uni-Terra that has been created by the Dacheverbandlehm e.V network in Germany.

- develop indicators to assess scientific quality;
- assess the impact of research and knowledge produced on changing practices;
- publish scientific articles in indexed journals of other disciplines;
- launch an international scientific journal and establish recognition on an "A" level;
- structure, pool and expand the dissemination of scientific results in a systematic and coordinated manner.

3.3. – Workshop 3

Workshop 3 :
Evaluation methods, validation of learning, certification of professional skills.
Participants : Robert Bidime'Nouga, Emmanuelle Devaux (reporter), Lydie Didier (moderator), Alexandre Douline (moderator), Rosario Etchebarne, Uta Herz, Serge Maïni (Satprem), Adolphe Mayogi, Jean-Marc Mei, Michel Mourier, Elena Ochoa Mendoza.

Towards the recognition of earthen architecture trades

The third workshop focused on the establishment of a system of certification and validation of either skills or levels and corresponding trades. This is basically to set up an "institutional" recognition of earthen building trades and earthen architecture so as to give them a "status", recognition within society. This applies to the entire range of occupations, from the apprentice to the architect and the specialized engineer.

The first thing to be considered would be the gradient hierarchy of qualifications. But an accord might be agreed upon based on different levels and trades on this hierarchy. Taking the French case as an example, the skills ladder is as follows:

Level 8: Doctorate
Level 7: Post master degree (DSA-Earth ENSAG)
Level 6: Architect or Engineer
Level 5: Section Engineer (professional license)
Level 4: Site Manager (Professional Bachelor)
Level 3: Mason (Certificate of Professional Competence)
Level 2: Apprentice
Level 1: completion of primary school

However, in view of a ladder of qualifications that would be specific to the field of earthen construction and architecture, levels vary from one country to another. Thus, in France, levels 6 and 7 can be covered with an opening toward a doctorate (level 8), whereas low levels 3 or 4 are covered in Germany, and level 4 of professional "baccalauréat" in Cameroon, for example.

Certify existing trades, and new emerging professions:

- Several observations and questions:
  each country has developed its own framework for certification;
- societal change is accelerating, and therefore, so are corresponding trades and qualifications;
- the "heart" of the trade is a type of employment. However, this changes at the interface of skill levels and the need for more "transversal" skills is noted (construction site site supervisor, for example).
- new skills ("eco-construction" masons, "sustainable" architects or engineers), seem to be able to position themselves in an emerging market. How can these new skills and professions be certified?

- why and how is it that training in construction and earthen architecture is not more integrated into the teaching curriculum in architecture and building engineering schools? Has this specific training really existed in the past?
- how can we go from informal, non certified systems to more formally certified systems, as part of an increasingly global market economy that is "regulated" by the interests of large industries and manufacturers, for which training "products" and the validation of systems, or levels of skill, are recognized by and suited to the industries' needs, and trusted by policy makers?

Even so, the “earth architect”or “earth builder trades” do indeed exist, and the qualifications are more or less identical from one country to another. In order for this longstanding trade and the necessary associated qualifications to become officially recognized, training itself must become certified.

An overview of situations in different contexts around the world

Workshop participants give an overview of the situation in their country.

In Uruguay[60] three levels are recognized: assistant mason, mason and head mason. But there have been no developments in terms of classic apprenticeship and it seems necessary to establish qualifying training for masons with different skill levels.
However, in the university, specialized training in earthen architecture has existed since 1994, as part of a course entitled "Introduction to Biodiversity". This is an introduction geared towards people at least fifteen years old, having completed their compulsory schooling, but with no previous specialized training. The course provides 200 hours of training over ten weeks with integrated projects conducted in conjunction with municipalities. This course is validated and recognized by a certificate given by the "Universidad del Trabajo", certificate which is obtained automatically when the two hundred hours of training have been followed. However, the skill level is elementary and the qualification level is that of apprentice. Negotiations have been going on for 4 years, at time of writing, with the Ministry of Labour, to establish a specialized skills training for masons. We must still note that in the entire region of Uruguay, Brazil, and Argentina, while much training is provided, that there has been no progress for 20 years in the field of certification.

In India[61], under the Auroville Earth Institute (near Pondicherry), the existing system is based on a continuous evaluation, is not subject to a final evaluation, and leads simply to a "participation" certificate. Two types of courses are offered: production and use of compressed earth blocks (CEBs), including training on building systems in arches, vaults and domes, both in theory and in practice, and formal training combined with a final personal work, including a personal project. Levels of these courses range from the "initiation", including practical training, to that of the “earth” qualification for architects and engineers. Thus, the proposed training is tailored to different skill levels.

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[60] Professor Rosario Etchebarne Scandroglio.

[61] Satprem, arch. Serge Maïni.

As for the evaluation of these trainings and different levels, which is done under well-defined criteria (such as those in France by the AFPA[62] for "professional" training in building trades) but under continuous observation of the trainer. Another more intensive training program that lasts from four to six months, and up to one year, consists of experience with a research/design office where students actively participate on detailed project design, site management and overall supervision activities. This comprehensive training completes an informal, supervisor-level training. But this system of training is informal and there is, to date, still no real training school in India. Also, is not "mandatory" to complete this training provided by the Auroville Earth Institute in order to work.

In France[63], through the AFPAs, masonry training concerns three levels of qualification: building and plastering a wall, framing of the vertical elements and framing of the horizontal elements in a structure. These activities are divided into lists of skills that are governed by building codes. The repository of the AFPA training uses the word "block" to refer to masonry blocks, either chipboard concrete, concrete, stone or even earth, and the mason must be able to form blocks with all of these materials. The problem is that earth, as a building material, is not typically part of the trainers' building “culture”, and thus they tend to speak of other materials and types of blocks at the expense of earthen blocks! Also in France, the certification corresponds to a salary scale to which the various trades can aspire, a scale set by the ministries of education and work. Certification is necessary for salary recognition, as part of the national collective agreement. The certification training provided by the AFPA is based on a continuous assessment done by the trainers, in the form of observations and evaluations based on the "admissibility" of projects, and also the "market value", and "visual" or "mechanical" criteria of works done by the masons in training. Moreover, the level of acquired "understanding" is adapted to work situations which are either "normal" and "predictable", or "complex" and "unpredictable". The French evaluation system is established by competent authorities, speaking in terms of "capabilities". Thus, each capacity, or competence, corresponds to a certain "trade". The review panels are composed of professionals and are supposed to certify skills expected for a given occupation. The evaluation system is based on exercises that simulate real life professional scenarios. This system also applies to those wishing to certify or earn recognition from prior learning and experience (VAE, or *Validation des Acquis de l'experience* in French). One must clearly distinguish the system of "training" under the Ministry of Labor and the system of "validation", which refers to the skills expected by the jury of "professionals". So there is an "Obligation of results" that does not take into account how such skills may be learned. It is therefore the criteria required by each profession or trade, and the verification of capabilities for a particular job, which define the context and content of the validation protocol. These validation criteria for the required capabilities also include on-time execution, and thus "performance".

In Mexico[64], coordinating a project involves bringing together the following trades: architect or engineer, job coordinator, master mason, masons and assistant masons. The CIPTEV was created because in the academic institution, there was no room to accommodate specific

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[62] AFPA : Association pour la Formation Professionnelle des Adultes.

[63] Jean-Marc Mei and Michel Mourier, AFPA of Saint Etienne.

[64] Elena Ochoa Mendoza, founder and director of the Centro de Investigación y Producción de Tecnología Ecológica para la Vivienda (CIPTEV), Zapopan, México.

instruction on earthen construction and architecture. It was necessary to get away from the "formal" system in order to fit, independently, in the informal system. This was the only way to ensure sustainability of training on earthen architecture.
The CIPTEV offers specialized training that provides one hundred and twenty hours in one year, designed for young architects and engineers completing their studies or having recently graduated. Training is also aimed at adults with high school degrees but not to masons. Validation is done based on the number of hours that have been followed as well as on the designed and/or constructed project. The current challenge is to obtain recognition of this training by the government and formalize the system. However, in anticipation of this possibility, trainees are not often interested in obtaining a certificate, but want to first acquire a "competence" in the specific field of earthen architecture, having already earned a satisfying university level degree. This also corresponds to the fact that in all cases, the work market never requires to present a diploma, but to demonstrate that one is capable of doing the job. In Mexico, as it stands, we observe that learning is usually achieved through an informal system, the transmission of knowledge and know-how is transmitted from generation to generation and that the presence of an architect is for building, to this day, not mandatory.

In the United Kingdom[65], the validation of skills is provided by evaluators (associated with certifying bodies) who come to observe the trainees on construction sites. The evaluation is done on different skill levels and their corresponding activities but not specifically on a "trade". The level obtained is validated by a certificate of qualification.

In The Democratic Republic of Congo[66], AMICOR created a training center for two categories of skills: "practitioners" and "technicians". The practitioner level is relatively low, concentrating on learning the techniques. Technicians have a mid-level skills base, based on theoretical and practical courses, and training is designed mostly to prepare trainees to become job site assistants. These courses award a certificate. Training is a key sector to AMICOR, which is also a business. The organization's purpose is to train site managers who will follow the association's projects. Training is also available for farmers on materials' production and construction. For this, AMICOR provides training to farmers over two weeks. Finally, a two-week training seminar for "partners" such as international NGO's, awards a certificate of attendance. But regardless of this effort undertaken for a better recognition of qualifications, the Democratic Republic of Congo still needs a more formal certification of qualifications and skills to better promote earthen construction trades and achieve better social and financial recognition for workers.

In Germany[67], the validation system is similar to the French system in that the competences validated correspond to skills and professional capacities to perform activities in a specific trade. In Germany, there are several small training centers that offer different types of courses that meet the diverse demand of civil society: introduction to earthen construction, for an audience of self builders and entrepreneurs, and other targeted groups. In the first level of initiation, participants to short courses of three to seven days are awarded a certificate of "participation". For higher levels, two hundred hours of training, recognized nationwide by the Chamber of Commerce, allows those who successfully complete the course to open a business, and such a program is therefore considered qualifying training. Moreover, to meet a wider demand for specific skills, there are also "external" courses that correspond to specific qualifications. Validation is conducted by a jury granting a certificate of achievement. Germany also offers the possibility to validate the achievements and experience for people who have a career without recognized qualification. An internship and a final exam will allow them to enjoy the same rights as persons with a recognized institutional curriculum. Finally, we note the existence of a new European project, project ECVET[68], European Credit System for Vocational Education and Training, with a first action called "Building with earth," focused initially on clay plasters, that aims to establish a knowledge repository and qualification certificates corresponding to a specific skill set. Through ECVET specific certificates will be awarded to validate modules included as part of the two-hundred hour skill training programs, in specific skill areas.

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[65] Uta Herz.

[66] Adolphe Mayogi, Ong AMICOR, Amicale des Autoconstructeurs Ruraux.

[67] Uta Herz.

The challenges of certification: Why? For whom? How?

One noteworthy point about the European context: only Germany has a system of certification of earthen construction. Nevertheless, in this favorable context, little building is currently done using earth. Conversely, in many other countries around the world, particularly in the Southern hemisphere, while certification systems are rare, earth materials are the most widely used in construction. Also, in many countries, the question of earthen materials does not arise because earth is an obvious economic and practical solution in terms of housing accessibility. Social demand is therefore at the qualification level. It is necessary, both for the better recognition of earthen architecture, and to encourage quality productions based on professional qualifications and recognized skills, to advance along the path of a specific certification. However, in existing training systems, specific "trades" dominate the building culture rather than “materials”, and the general trend is simply to use existing "dominant" materials (concrete, cement blocks, steel) though this is not clearly expressed.

Moreover, at the heart of the social debate on the validation of professional qualifications, the role of "authorities" is emphasized as they expected to ensure both safety and quality by implementing certification. This validation process by authorities implies the existence of an "external" inspection and therefore the prerequisite need to train inspectors / examiners who can validate the qualifications in the field, in training centers and on job sites. Currently, there is training available for teachers, but no training available for inspectors.

How then can we move towards the establishment of national certifications? Should we not circumvent the diversity of contexts, and the complexity it imposes, by acting more broadly at the international level and working in networks of accredited institutions at this level? And how can we support and facilitate more commitment and strategic involvement on this important issue of certification?

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[68] Acquis.Terre : *Le système ECVET Construire en terre, pour des parcours de formation européens. Cap sur la terre.* CRAterre éditions, Grenoble, France, November 2009, 24 p.

What methods of validation?

Validation of professional qualifications equals a "title" or a "trade", and is obtained after a training course, based on validating tests, or by the procedure of validation of knowledge and experiences, when dealing with a candidate who claims to exercise a recognized profession. Is this procedure still appropriate, or is it desirable to modify the mechanism of validation of professional qualifications to give more specificity to earthen construction?

Responsibility for certification

Today it is mainly "authority" that is responsible for certification; that is to say, the Ministry of Labour, the Ministry of Education, corporations or professional networks. For earthen construction, this situation gives huge weight to the will of political authorities and it is desirable that the certification of qualifications in this field of be carried out by a “competent” public authority.

What is certified, precisely?

Certification validates both the skills and the achievements of a person after training, and her experiences in a field of activity corresponding to a particular "titled" profession (apprentice assistant, mason, bricklayer, mason chief, etc.) or skill (building a wall, implementing a wall coating, etc.) and thus a related "diploma". All that adds up to a complicated process, and it would seem necessary to simplify the writings that currently govern certification processes, and to give them more flexibility. The validation of skills process should be better reflected upon, in preparation of certifications, especially as the market's needs have changed and the old systems of certification of skills do not work as well in this regard, and remain focused on "activities". Moreover, should we "isolate" or "specify" the specialization of earthen masonry, or put it on the same level as others? Should certification also involve a "quality guarantee” approach or not? And how can we certify the "production" or prefabrication of materials in relation to the certification of the implementation of these materials? Should the production of construction materials be considered separately from that of construction, since the mason is usually not the one who produced the material but who uses it? All these questions are also related to the peculiarity of "contexts" of certification, which is to say the needs, customs and resources of different countries or cultures. Is it desirable to move towards greater international harmonization or otherwise maintain a diversity of approaches and methods of certification?

What process for the establishment of certification?

Addressing the process of implementation of certification raises the corollary issues of setting up specialized training and an accordingly specialized method validating, based on a clear vision of what constitutes the earthen construction and architecture “trade” and its response to market's needs and expectations. This implies the need to set a frame of reference for the certification of such trades. Moving in this direction means being able to lift a series of mostly bureaucratic and administrative obstacles, allowing the submission of application files for the certification of specialized training programs by relevant authorities (ministries and departments concerned, vocational training bodies, construction guilds, etc...).

Simultaneously, it is essential to remove other barriers that contribute to non-recognition of earthen construction materials by the industrial sector of material production, as the industry prefers to keep a monopoly on the sector, rather than allowing more democratic appropriations.

Feedback from experiences on the issue of certification in some countries

En France[69], it is not yet possible to introduce an “earth” specialty in the existing certification procedures. Now, faced with an emerging social demand for the use of "natural" materials, or "eco-materials", the best strategy would be to prepare the field of earthen construction by offering vocational training that directly impacts employment. To do so, authorities and bodies with the power of certification should be sensitized, and convinced – such as the CNCP, the National Professional Certification Commission – of the economic, environmental and cultural potential of a specific recognition and certification of earthen construction. We should be able to integrate an “Earth” option into the protocol for assessing qualifications for construction trades, as part of the protocol of tests and examinations. This would allow incorporating earthen materials, as well as other materials, into the curricula of existing training. This is a first step if we want to be able to tackle other steps involving training programs, certification standards, repository activities / skills (REAC), and employment. This approach seems valid for all countries.

It should also be noted that, in many French regions, the masons who are trained will have to intervene on a large “heritage” market; in activities linked to restoration, renovation or rehabilitation, and that they may not have been trained to this, or even made aware of it. Also in France, the AFPA[70] (Association for Adult Vocational Training) created, three years ago ATOW, a new "mason of ancient buildings" degree to better address this question of intervention on built heritage areas. But upon its launch, the qualifications that this diploma validated failed to include “earth” as part of the curriculum. This seems incongruous if we take into account the true measure of the quantitative and qualitative importance of old buildings constructed of earth in a large majority of French regions for which the AFPA, on both departmental and regional geographic scales, should be directly motivated. Nevertheless, the creation of this new diploma and the training that leads to it should be considered a breakthrough because they provide a framework for “Earth” curricula and other qualifying diplomas. This would be possible provided that the Department of Labor agrees to revise the "titles" of existing trades, without necessarily accepting that "new" titles be created. This revision involves a change in certification standards. Currently, the jury members who certify skill levels are professionals "authorized" by the Department of Labor. Certification is based on practical exercises that must meet eligibility criteria (vis-à-vis the potential "client"), and an interview with the jury based on the screening of a personnel or professional candidate file. In fact, if earthen construction were to be introduced in the training, it would require that the examiners be familiar with the subject it so that they would be able to appreciate and evaluate qualifications.

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[69] Lydie Didier

[70] MM. Michel Mourier and Jean-Marc Mei, AFPA of Saint Etienne.

Neither must we neglect the potential interest of "professional sectoral files" that may be established on the basis of the needs of professional categories in coming years. These files allow users to specify the requirements for qualified people to train for different sectors of the trade, in order to meet the requirements of a changing market. The introduction of an “earth” market implies the establishment of a new sectoral professional file.

Also in France[71], from the academic perspective and in relation with the French context, it is important to have a "public" certification. Therefore, CRAterre remains attached to the National Superior School of Architecture of Grenoble, which provides an institutional framework that contributes to the public recognition of earthen architecture, and leads to a professionalizing post-master diploma. Architects, engineers, archaeologists, conservationists, heritage managers, all "specialists" in earthen construction and architecture, conservation and enhancement of built heritage, have been all trained through the The DSA-Terre since its establishment in 1984.

In Cameroun[72], a new law allows the use of compressed earth block (CEBs) for the construction of rural schools, of up to two storeys. This implies that student-masons are trained on this material and its use in construction. The country has established standards for CEBs and the presses to produce the blocks can only been handled by workers whose qualification is recognized and acquired by appropriate training.

In India[73], so-called "Barefoot" architects in the field of earthen construction are, for the vast majority self-taught. How to certify this informal occupational profile is a major issue in the region. Moreover, introducing such training in the curriculum for architects, engineers, masons, would also lessen the divide between the "white collar" and "blue collar" workers. The existence of a certification for different skill levels and recognized trades, with a substantial salary, would then contribute to greater social justice.

In Uruguay[74], strategic efforts are being made to lead to certification. The idea is to try to introduce earthen architecture into the current curriculum of training for masons at the Labour University of Uruguay (UTU). More attention also needs to be given to earthen architecture in universities and colleges that train architects and engineers. As this is still very difficult, private training centers have been developed in several Latin American countries. These courses provide good quality training at all levels. It is therefore necessary to facilitate the collaboration between these centers and private authorities and bodies which are responsible for the certification of professional qualifications.

Currently, **in Mexico**[75], nearly seventeen thousand architecture students graduate each year, and many of them are unable to find a job. In spite of being perfectly competent, they are unable to find work on the market. CIPTEV is the a private initiative that provides architecture graduates an earthen architecture “supplement” to their initial training. But this training is not officially certified at the national level, that does not recognize earth as a building material in its own right. Can we not raise the issue of the establishment of an international certification recognized by a network of experts, professionals, trainers such as networks of the UNESCO Chair and PROTERRA?

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[71] Alexandre Douline.

[72] M. Robert Bidime’Nonga.

[73] Satprem, Serge Maïni, Auroville Earth Institute.

[74] Professor Rosario Etchebarne Scandroglio.

[75] Elena Ochoa Mendoza, Director of CIPTEV, Zapopan, Jalisco, México.

In Germany[76], the system of certification of skill levels is governed by the Chambers of Trade. The validation system is composed of three modules that each include a proper examination. The juries are composed of one business representative, an employee representative and a representative of the trainers, all approved by the Chamber of Trade. This jury is an independent assessment committee which is often conducive to intergenerational exchange of knowledge, know-how and experience.

Workshop 3 - conclusions and some recommendations

The workshop participants agreed on the need to further reflect upon the issue of certification of qualifications and skills associated with "titles" or "trades" in earth construction. It is highly desirable that this issue of training take more space in seminars, conferences and workshops, nationally and internationally and, if possible, to hold another conference like TerraEducation 2010 in order to make this matter evolve. The establishment of a forum for the exchange of thoughts, ideas and sharing of information is encouraged to better support each other internationally.

It is important to share documentation on the issues of education, training and construction of earthen architecture while not neglecting the exchange of documentation on training in building trades in general. Current situations in different countries must be better evaluated and the identification of who does what must be updated.

The UNESCO Chair could play the role of forum and platform for such exchanges, to better unite and "formalize" elements, with its recognized authority in the field, and on a UN scale. A concerted international reflection on this vital issue of the establishment of frameworks of professional qualifications, and references by activities and skills, may be favorable for progress in the different national contexts

Simultaneously, it is very important that the dynamics of reflection and discussion on these issues be supported and enabled within national, regional and even continental networks, such as national associations of earthen constructors, the networks issued from the 2009 Africa program, the network PROTERRA, the European network which was initiated with ECVET program partners, and the international network of the ICOMOS specialized Committee (ISCEAH).

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[76] Uta Herz.

3.4. – Workshop 4

Workshop 4 :
Difficulties, knots and blockages, occurrences and accelerations for the development of education and specialized training in construction and earth architecture.

Participants : Erica Avrami (modérator), Maddalena Achenza (modérator), Maria Fernandes, José Raul Moreno Cardenas, Ishanlosen Odiaua, Bakonirina Rakotomamonjy (rapporteur), Mirta Sosa, Abdelghani Tayyibi, Marcelo Washl, José Manuel Rivas Zacatares.

The fourth workshop was to discuss difficult issues, with the goal to better assess current challenges, knots and obstacles and to identify opportunities to further develop specialized training in construction and earthen architecture[77].

Evolution of social issues and responsibility of educational institutions

The current era is marked by a clear evolution of the needs of society, calling for both global and locally specific responses in many areas, among which the following should be noted:

- the dramatic expansion of poverty and even misery, with an increasingly important low-income population;
- social injustice in access to work, with rampant unemployment rates affecting many nations, primarily in the South but also in the North, and the consequent lack of access to decent housing, exacerbated by urban growth and an influx of poor populations in suburban areas;
- these difficulties are generally associated with problems linked to malnutrition and poor health conditions, which local economies and politics fail to resolve in many nations;
- lack of access to education at primary, secondary and tertiary levels for children from the poorest families, augmented by a weakening of the public sector and the privatization of educational institutions contributing to the establishment of a social class system and a heightened social injustice;
- an accelerated degradation of the natural environment associated with a worrying reduction of non-renewable resources (rare minerals) and energy scarcity (oil reserves, water) and problems associated with various types of pollution linked to climate change;
- an international financial crisis: inflation of loans, sub primes and securitization, real estate crash, stock market crash, indebted populations and nations, economic crisis and declining investments; and many other difficulties.

In this context of strong pressure on today's society, alternative solutions with a viable social, environmental and economic potential should be supported. In terms of access to housing for the poor and the development of local economies based on the establishment of an earth construction sector, and other industries valorizing local resources, and impulsing sustainable development (ecological and energy alternatives) earthen architecture probably has a crucial role to play.

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[77] This summary of the workshop 4 refers to the presentation made by the working group at the end of the seminar, with a power point presentation in 23 slides that was prepared by Bakonirina Rakotomamonjy.

However, much needs to be done to valorize the building cultures of raw earth, their evolution and adaptation to current needs and demands of modernity, the characteristics of quality earth construction and architecture and the achievements in terms of energy efficiency, in a global context which requires more and more normative frameworks. There is a significant paradox between a normalization process that evolves very slowly and the accelerated need to respond to society's demands in housing, in peri-urban areas or in rural areas where new policies for urban planning must take better account of new scales of urbanization and distribution services.

As for higher education and vocational training for earthen architecture, a huge gap in terms of qualifications and skills must be filled in order to develop specific trades, and their social and economic recognition.

In this endeavor, educational institutions have the responsibility to meet the challenge of special education, to transmit knowledge not only to professionals of different levels of qualification (from masons to architects), but also to local communities and their leaders.

Responsibilities of educational institutions toward the field of earthen architecture were identified through this fourth workshop at the following levels:

1. the global paradigm shift and its local applications;
2. institutional legitimacy of education systems in the field;
3. expansion of specialized networks;
4. the development of research, basic R & D, and action research;
5. integration of special education in public policies;
6. the development of professionalism in the field;
7. development and expansion of technical training;
8. communication;
9. support and assistance to communities.

The paradigm shift

If we declare today that society has "the right to use the land," it seems more appropriate to say that it has "the right to access to housing and healthy environment." This change of scale in terms of what our rights are imposes a new paradigm.

The idea is to "think" earth architecture through the prism of a broader vision, beyond earth as a material and beyond the mere concept of "earthen construction". Earth architecture is connected to society, the people of the world, putting to use their own constructive cultures (knowledge and skills), reaping social and economic benefits. However, very often, when education on earthen construction is offered, it does not take sufficient account, if any, of this cultural heritage and, to an even lesser extent, of the diversity of contexts. The "global" is beating the "local". A radical change is needed and it is important that all pedagogical engineering is revised - including teaching methods and tools - and be adjusted to this paradigm shift.

Institutional legitimacy of the education system

Despite the real motivation of many educational institutions of higher education and vocational training, these do not enjoy sufficient recognition and their role is not legitimate enough in the eyes of society. However, such institutions have the legitimacy to develop education for earthen architecture as it now offers a great potential for addressing the needs of society. In fact:

- earthen architecture is part of the cultural, social, economic and environmental identity of a large portion of the world's population.
- earthen architecture is a vector and a lever to provide answers to issues related to social vulnerability, environmental sustainability, access to social housing, the better management of economic growth, greater social justice, and self-determination of peoples.

The network of the UNESCO Chair "Earthen Architecture", which counts among its members representatives of educational institutions of higher education and vocational training, is a powerful tool to support the development of special education in the field. The chair should be more proactive in encouraging that education contents are actually developed in universities and training centers, and in promoting the establishment of agreements focused on this objective, in collaboration with institutional members of the network. The Ibero-American network PROTERRA and other national networks, which also include representatives of educational institutions, should fulfill the same role. This would contribute to a better recognition of the institutional legitimacy of universities and other training centers in the field of education for earthen architecture.

Universities do not fulfill their role as influential agents or make enough use of their *lobbying power* with policy makers, as with the private sector, even though they have the legitimacy to do so as part of their institutional mandate. It is therefore necessary to reinforce the influence of universities on the choices made by decision makers, educators and researchers, professionals and more widely the civil society. This would also help to facilitate the implementation of fundraising activities for the development of educational and scientific ventures. The UNESCO Chair should b able to support this critical mission.

“Pseudo-experts” in the field of earth construction seem to be spreading at an alarming rate. Such “professionals” provide low quality services and results. The attractiveness of “juicy” markets does not always mix well with the ethical quest for the production of quality constructions and architectures. This is where educational institutions could play a part, in making sure that best practices are developed. Educational institutions can hold a “leader” position in this matter by:

- implementing systems to assess the quality of construction and architectural projects;
- validating best practices for interventions, both dealing with the material (built environment, heritage) the immaterial (crafts, arts, cultural identities);
- contributing to the visibility of excellence achievements that would give more value and credibility to earthen architecture in the eyes of civil society;
- fulfilling civic solidarity activities, through the development of collaborative and participatory projects, involving professionals and civilian communities.

Develop and strengthen networks

Even if great coordination efforts have been made over the past decade, particularly in terms of sharing and the dissemination of information (PROTERRA, Arqui-terra), much remains to be done for a more effective networking of professionals at national, regional and international levels.

There is indeed a reproduction of efforts among differentiated networks. The UNESCO Chair is not visible enough and networking lacks efficiency as network members struggle to disseminate and share their activities as well as to produce an annual report, in spite of the fact that such a report is requested by UNESCO and the French National Commission for UNESCO. To overcome this lack of visibility, updated information on the Chair was made available on the new website of CRAterre and a data exchange portal will soon be activated.

It is therefore necessary:

- to strengthen existing networks, making them more active, for a better sharing of information;
- to properly identify members and their status, giving them better visibility;
- to rely on networks to search for opportunities to request and raise funds;
- that members of the UNESCO Chair produce an annual report on their activities;
- to organize seminars to assess progresses being made; for this purpose, evaluation indicators must be defined;
- that members of the UNESCO Chair assume responsibility and fully meet their unifying and coordinating role at national, regional and international levels;
- that the mission of the members of the UNESCO Chair is more clearly defined and that an agreement between members is co-signed.

There is also a lack of dissemination and implementation of new knowledge and educational tools and materials. This lack may be in part compensated by better sharing information within networks (intranet) and providing at least a brief description of new tools and educational materials that are produced. Questions regarding copyrights must also be clearly addressed.

For the better integration of educational policies

Clearly, there are significant gaps in the development and implementation of public policies and legislative frameworks concerning earthen architecture, together with a lack of affirmation of the need for political and educational strategies in the field. Universities do not, or only partially, fulfill the influential role they could play among decision-makers in the field. This lack significantly contributes to:

- a lack of recognition and awareness of the societal value of earthen architecture among professionals (including the private sector), and more broadly the civil society;
- a lack of financial resources allowing a more important development of earthen architectures.

Acting in favor of a better political integration of earthen architectures directly concerns universities and their full institutional legitimacy in matters of education. They can better fulfill this mission by:

- creating a shared platform to develop a real political agenda among universities and in relation to policy makers, government bodies, NGOs, the professional and public and civil society representatives (associations, communities);
- producing and sharing case studies that give value to the analysis of the financial and socio-economic benefits of projects undertaken;
- producing and sharing life-cycle analyses for environmental models;
- adapting model indicators.

The place and role of research

In terms of research on earthen architecture, three major problems are identified:
- the lack of clearly established relationships between scientific research, knowledge transfer, and the realities of various application contexts;
- the lack of sharing of research results with a wider range beneficiaries;
- the need to develop much more useful research projects, in tune with the real needs of society.

It would be advisable, of course, while continuing to develop basic research on earth as matter and on earth as a material, to work on more experimentation, R & D and applied research, particularly in the context of pilot projects that directly involve professionals, stakeholders and beneficiaries. Such “contextualized” research activities should also be used to pursue the creation of more easily shareable and adaptable teaching methods and materials.

There is also a considerable lack of coordination of the scientific research at the international level, with a duplication of efforts leading to a waste of human and financial resources. Networks should play a more active role to reduce this and establish a more visible coordination.

Doctorate (PhD) research works are not quite focused on a set of priority issues, among which we can identify the following:
- the comparative analysis of the financial and economic benefits of earth architecture;
- the analysis of case studies on earth and concrete architectures;
- studies on traditional earthen architectures and building cultures;
- studies on craft production processes, inventories, documentations and evaluations.
- publications on earthen architecture are mainly written by professionals and specialists and aimed at this same category of people.

The paradigm shift mentioned earlier implies the need for more interdisciplinary. In this sense, the creation of a scientific journal, led by the UNESCO Chair, could help meet this need to publish multidisciplinary articles and facilitate a comparison of views and analyses, and reinforce collaborations between the different departments of universities.

A necessary development of professionalization

A lack of recognition of the professional value of academic institutions centered on earthen architecture is noticed. More viable strategies should be applied in order to:

- disseminate the works of universities locally;
- facilitate collaborations between universities, their faculties and departments;
- facilitate cooperation between different business entities.

Similarly, a lack of specific competences on earthen architecture in academia is noticed, as well as the existence of "pseudo-experts". It is therefore very important to legitimize the institutions that perform quality work on the basis of an assessment and of clearly defined indicators.

Professionalization implies that, first of all, vocational trainings involve teaching methodologies and materials that are best suited to the needs of students. The following conditions seem necessary:

- identification, evaluation and sharing within networks (intranet), of at least the title and a brief description of all educational materials that have been produced by the international academic community (while clearly addressing the issue of copyrights);
- production of educational materials on the basis of knowledge accessible to all teachers and trainers, regardless of the contexts of use, in order to facilitate their wide dissemination;
- production of summaries for students that are adapted to different linguistic contexts (translation of documents).

Development of earthen architectures also suffers from a lack of integration between popular knowledge and academic knowledge, as each uses a different language. Educational research can play a role to facilitate this integration and produce educational materials better adapted to both contexts.

There is an obvious imbalance between “top-down” and “bottom-up” approaches. A change of attitude is needed to better focus on a bottom-up approach of teaching methods and the training of professionals, including architects, so that they become the "facilitators" of the development of earthen architectures, by providing their support to communities.

The lack of integration of interdisciplinary approaches in the teaching of earth architecture tends to generate highly technical curricula that do not sufficiently take into account the complexity and the different dimensions of building, building materials, constructive cultures, architecture, customs, cities and territories. This can be corrected by welcoming students from different disciplinary backgrounds in training programs.

The lack of teaching in certain subject areas implies the need for the development of education on the following:

- improvement of social housing;
- building cultures, living cultures, customs;
- the tangible and intangible earthen immovable cultural heritage;
- project management;
- professional ethics;
- interdisciplinary approaches;
- craft skills and businesses.

Developing technical and craft training activities

It is easy to see that artisans and businesses are the main actors of development and that their competences in the field of earthen construction are still very poorly recognized. This situation could evolve:

- through the development of education programs that involve artisans in more direct ways;
- through the certification of the qualifications of craftsmen.

Similarly, artisans suffer from a lack of viable markets. To change this situation, several leads were identified:

- develop craft skills and support their implementation;
- better identify and analyze existing and potential markets;
- promote exemplary achievements that demonstrate craft and business skills: pilot projects, architectural references, facilitating a better integration of earthen architecture as part of development programs.

The loss and degradation of traditional knowledge and skills today poses a serious problem that contributes to block the development of earthen architecture. It is thus necessary to:

- develop teaching materials for the specific training of artisans;
- better study the production process of local crafts by performing inventories, gathering documentation and qualitative assessments.

Deploying of great communication efforts

The sectors which invest the field of earthen construction and architecture, whether academic or professional, are not sufficiently recognized. New strategies must be deployed to develop operational forces acting at the interface between universities and governments, to play a more active influence game.

The majority of the publications are aimed at the sectors that produce them. Too few publications highlighting the diversity of earthen architectures and building cultures around the world are aimed at the general public, as is the case for other domains.

Launching an interdisciplinary, high-rank journal is a priority initiative as it is absolutely necessary to make publications in journals dealing with other disciplines.

Also, the wide range of available communication media should be put to better use to sensitize and promote: exhibitions, videos, documentaries and films, radio.

Because our academic sector pursues a broad set of goals and objectives, it becomes absolutely necessary to reinforce our communication with policy makers, researchers, professionals and the civil society. A greater communication capacity must be built, to better express our goals and objectives, aimed at different target groups. Articles and other texts produced to accompany communications effort should be written using a vocabulary and a language that is better tailored to target audiences and may divert a bit from the canons of scientific writing, or avoid being too general and banal.

Support communities in achieving local and regional development

Our academic institutions are not responding enough to the expectations and needs of local communities. Universities need to better fulfill their civil and social missions by facilitating access to knowledge and bringing a transfer of information into the field, aimed at stakeholder groups that should be the primary beneficiaries. This has been previously addressed but the following directions should also be taken into account:

- develop, support and monitor actions in favor of the most vulnerable populations;
- develop and promote skills in the craft and trade sectors, and disseminate best practices; promote and organize professional and technical training programs involving the civil society.

4 - MAJOR CONCLUSIONS AND DIRECTIONS

Earthen architecture at the heart of a motivating political agenda

The main conclusions and guidelines of the TerraEducation 2010 International Seminar will not restate the synthesis elements presented in the first part of the report (chapter 2) that value the contributions of all participants as expressed in their previously published papers and articles[78], nor the work conclusions from the four workshops (chapter 3). It seems more appropriate to offer an overall assessment to establish the basis for actions to be implemented in the short and medium terms, to better organize, coordinate, support and enhance the development of education for earthen architecture.

The work achieved during the TerraEducation 2010 seminar restores conclusions from an intensive reflection process, both individual and collective, from a group of strongly invested and enthusiastic participants that have developed, for several years, various teaching, training and research projects, facing political difficulties in their own countries or within their parent institutions, difficulties of a material nature due to a lack of resources, but maintaining a real commitment that allowed to contribute to the progress of contemporary earthen architectures. These participants believe in the virtues and values of earthen architecture, and the fact that earthen architectures can actively contribute to a fundamental social paradigm shift, centered on the access to housing and the importance of a healthier environment for a growing number of people, especially vulnerable populations. These participants understand the importance, in a globalizing world, to preserve the diversity of backgrounds and “located” cultural identities, to provide the conservation and valorization of earthen architectural heritage, both tangible and intangible that needs to be understood and recreated, and without which the future is inconceivable, as stated by the philosopher Simone Weil said (in *L’Enracinement*, ed. Gallimard, Paris, 1949).

TerraEducation 2010 allowed to highlight a set of strategies that can help remove blockages, untie knots and overcome resistances opposed to the development of specialized education programmes, but also to the unfolding of opportunities that stakeholders in the fields of education and science and professionals invested in the earth construction sector can benefit from, to gain recognition, visibility and efficiency of action.

This international seminar has contributed to better enable the networking of a group of specialized actors, already active at national, regional or international levels, and to give more visibility to the responsibility of educational institutions, called to strengthen their sense of legitimacy to prepare the future, by training new generations of professionals who will play a critical role in supporting society, "facilitating” sustainable development, both global and local. To this end, all trades linked to the earth construction sector, leading to the production of quality housing (at the scale of architecture, the city and larger territories) should be prepared, training programmes should be implemented and qualifications must be certified in order to become better recognized.

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[78] Ibid : AA.VV. 2010 – *TerraEducation 2010. Communications – Lectures – Ponencias*. Editions CRAterre ENSAG, Grenoble, May 2010, 237 p.

The challenge is both important and significant. However, the current social context of needs and expectations seems favorable, as it implies the fundamental reconsideration of industrial and socio-economic development models their damaging impacts that can now be clearly perceived and evaluated. Pushed to the limit, the international political agenda of many nations began to take note of the new paradigm and in this context; the future of earthen architecture seems like increasingly valid option to provide relevant answers taking into account the five pillars of sustainable development: environment, society, economy, culture and governance. In this endeavor, due to their institutional legitimacy in education and research, universities have an important role to play.

Great efforts still need to be devoted to the exchange and sharing of information, to the development of working tools (didactics, pedagogy), to the communication of results, to the coordination of human and material investments in research, to the development of architectural quality demonstrations, housing projects and local actions involving a wider range of civil society actors, the main target beneficiaries.

Universities occupy a central position in the development and strengthening of relationships, cooperations and collaborations, not only among themselves and through an interdisciplinary approach, involving teachers, researchers and students, as previously noted, but also integrating other stakeholder groups such as policy makers, professionals at all skill levels, communities, self builders and a more general public.

More than ever before, great efforts must be devoted to the exercise of citizenship and solidarity missions by universities. TerraEducation 2010 has helped to clarify this fact and to reveal more awareness of the need to disperse less energy and resources, better join forces, better network and reduce isolation and division.

Today, there is a political agenda for earthen architecture that universities, training centers, NGOs, professionals, associations and the civil society must take full responsibility for, with a better federation and sharing of human efforts and material resources.

Strengthened through our difficult but fruitful investments, our values, our legitimacy, our shared vision, we can move forward with greater confidence to find ways to implement an action plan in education, research and the application of earthen architecture, recognized by the "experts" as useful for society, a fact that remains to be demonstrated for a large majority.